FOOD INDUSTRIES

manufacturing and processing

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Two New Improvements in the Oldest Food Industry

IT IS VERY DOUBTFUL if there is any art or industry that is older than that of slaughtering animals for food. If antiquity were a factor in the progress of industry certainly we should expect that the meat industry ought to know all there is to know about itself. Yet with a history that reaches back for thousands of years, the meat industry is still conducting research and is gaining profitable knowledge.

Very recently Armour and Company has developed a new method of cutting up a beef that will give a greater proportion of profitable cuts. And still more recently Swift & Company has developed a new method of chilling beef whereby the meat is said to be more tender and has a better appearance than would be the case if the beef were chilled in the "hung" position. The new method consists of hooking the side of beef on a wooden frame so that all structures and muscles are in the relaxed position before chilling.

Such inventions are cited because of their simplicity and because one of the oldest of the arts has shown that it is capable of further development. The mere fact that an industry is venerable carries no evidence that it is in a fully developed condition, but, quite to the contrary, its antiquity frequently connotes that very little is known about it. If it were very new it would be studied intensively, but being old it is often neglected. There is no time nor date when research may be safely stopped.

Packers' Consent Decree Should Be Rescinded

THE LARGER PACKERS, speaking through Armour and Swift, have requested the federal authorities to so modify the Consent Decree of 1920 as to permit them to make full use of their manufacturing and distributing facilities, unhampered by any rulings that do not affect all packers alike. It is pointed out that recent far-reaching changes in methods of marketing have rendered unnecessary the restrictions imposed by the decree, principally because of the fact that many organizations, and especially chain food stores, have so developed as to render quite impossible any monopoly or restraint of trade.

Furthermore, the point is made by F. Edson White, president of Armour & Company, that there is involved a certain and by no means inconsiderable economic loss in further insistence upon legal restriction of the activities of the four leading packers—and of them alone. This is all the more evident by virtue of the fact that the larger packers are well equipped to extend their operations in food manufacture and marketing.

An additional point is that continuance of the present decree tends to throttle open competition, inasmuch as other packers and other organizations not in the meat industry are permitted to do, and are doing, the very things prohibited to the four large packers.

It would seem that justice lies on the side of the meat-packing concerns that are bespeaking of the federal authorities a fair field and unhampered liberty to compete with other food manufacturers. It is, of course, a part of common knowledge that many of the smaller packers have established retail outlets throughout the country, and in so doing are serving both the public and themselves in true economic fashion. Also, it is known that several of the large chain stores operate packing plants, one of them, with 2,700 meat markets, owning two meat-packing plants and a sausage factory. This is a day of integration, both vertical and horizontal, and it is difficult indeed to defend logically an act the purpose of which was openly avowed to be the differentiation of four large concerns from all others in the food industries.

Tariff Rates as Suggested by the Senate Finance Committee

THERE was made public recently the report of the Republican members of the Senate Finance Committee embodying their suggested findings as to the rates of the Hawley-Smoot Tariff Bill, now before Congress. As compared with the bill as it left the House of Representatives the revisions are, in the main, downward, although the general level contemplates rates that are substantially higher than those in effect at present.

It is reported from Washington that, despite the fact that agricultural rates were raised in numerous instances by the Senate committee, and industrial tariffs lowered, leaders of the farm bloc express themselves as dissatisfied with the present form of the bill as a farm-relief measure, and as being ready to join with many of the Democrats in an effort either to have rescinded most

of the industrial increases or to endeavor to defeat the whole tariff program at the next session of Congress. It was even suggested by the leading Republican paper in New York City—although not by the Democratic organs—that the Democratic party might present a tariff bill of its own, a news item that speaks eloquently of the difficulty of pleasing all elements of our complex industrial body.

Under the tariffs suggested by the Senate, the rate on raw sugar is placed at 2.75c. per pound, as compared with 3c. per pound in the House bill and 2.2c. per pound at present, the rate on Cuban sugar being 80 per cent of the foregoing. Refined sugar is given a duty of 2.98c. per pound, the House figure having been 3.5c. per pound and the present rate being 2.39c. per pound, the differential in favor of Cuban sugar applying here also. Rates on molasses vary in proportion.

As compared with the House bill, rates are increased on casein and other dairy products, poultry, lemons, prunes, maple products and onions, as well as on flaxseed. Other duties on foodstuffs are either left at the rates established in the House or lowered slightly, as is shown in our current Washington news.

The program of the committee, so far as it is completed, was announced as subject to alteration when the bill is on the floor of the Senate, at which time the administrative features of the Hawley Bill will be given Senatorial attention. This will probably be on or about September 4.

Noisy Grape Fruit Are Not Good

IF ONE IS UNACQUAINTED with the details of researches in the realms of physics and subatomic chemistry, it may seem to be a very far cry from radio to food, yet within the last thirty days a report of the development work of the Bell Telephone Laboratories bears out the possible usefulness to food producers of recent discoveries in physics. This rather spectacular application of science is a method of detecting the Mediterranean fruit fly when it is inside citrus fruits. So far no way has existed for the detection of the larvæ of the fruit fly inside the fruit without cutting it open—an operation which, of course, renders the fruit unsalable. The skins may appear to be healthy and yet cover a fruit that is infested with larvæ that should be destroyed.

Since the worm eats by tearing off morsels of fruit, it has been argued by government entomologists that a noise should be caused by the operation, and if this sound could be sufficiently amplified by means of the thermionic valves, or tubes, by which radio has become a possibility, the noise of the larvæ eating in the fruit should be audible to human ears. Apparatus in the nature of a glorified stethoscope has been constructed to test out the theory, and it has been found that "suspected" grapefruit were noisy, and on cutting them open they were found to contain the offending pests, whereas "silent" grapefruit were free from larvæ.

Although it is too early to predict the commercial significance of this new device, it appears to be based on well-grounded theory. Indeed, other apparatus is already in commercial use that is based on another but similar sort of phenomenon, the so-called capacitative effect. Certain of the earlier radio sets, particularly those without proper shielding, were very difficult to tune because the movement of the hand of the operator in the vicinity of the set had an influence on the reception of the instrument. This capacitative effect has been employed in a new type of burglar alarms, whereby a distant warning is sounded by any movement of a person in the vicinity of the safe that is under its protecting guardianship.

Another use of this effect has been in the automatic inspection of pill boxes. A small closed metallic box that contains six pills weighing five grains each is too tiny to weigh automatically to determine if it contains the proper number of pills, but by proper amplification of its capacitative effect it is possible to run the filled boxes in a continuous line through the inspection apparatus and automatically throw out any box that contains fewer than the required number of pills. All of this is accomplished without opening the pill box.

Such instances as these show that to the prepared mind there are always news ways to solve difficult problems, and that new tools are constantly being placed at the disposal of man. The method of testing grapefruit appears to be one of the earliest uses of sound as a method of determining the wholesomeness of food, with the one possible exception of the time-honored but uncertain custom of thumping a watermelon or a cheese—or a coconut.

Again the Specter of Spontaneous Heating

AT FREQUENT INTERVALS the dread fire hazard of spontaneous heating of industrial materials rises to disturb the peace of mind of food-manufacturing executives. Fire prevention executives and government officials have decided that this recurring unsolved problem has gone long enough without investigation. They propose to hold a conference in Washington later in the year, at which all parties interested in this problem will get together to discuss the difficulties and recommend means for overcoming them.

Elsewhere in this issue is a short article which makes clear some of the important and serious phases of this hazard. That discussion relates principally to sugar and burlap bagging, inasmuch as there seem to be numerous instances involving these two materials regarding which some dependable information can be had. This does not mean that only those storing sugar or using burlap bags should take notice. Many other industrial materials wrongly handled, especially agricultural raw materials used by our industries, demand investigation.

We hope that every one of the many food industries will take an active interest and an appropriate part in the forthcoming conference and any possible subsequent investigations based thereon.

Technical Assistance to the Soviet Union

AT PRESENT there is being displayed considerable interest by Russians in the help that our industrialists can give the U.S.S.R., acting through the Amtorg Trading Corporation of New York City.

During the past two years contracts for technical assistance have been placed by the Soviet Union with individuals, firms, and manufacturing companies, the list including the Radio Corporation of America, General Electric, du Pont, Nitrogen Engineering Corporation,

Ford Motor Company, Longacre Engineering & Construction Company, Arthur P. Davis, Harry D. Gibbs, Taft Pierce Company, Archer E. Wheeler, C. F. Seabrook Company, Foster-Wheeler Corporation, Hugh L. Cooper & Co., Lockwood Greene Engineers, Inc., the McCormick Company, Stuart, James & Cooke, Freyn Engineering Company, Albert Kahn and Frank Chase. Industries covered include the electrical, steel, coal, cotton spinning, oil, chemical, construction, baking, automotive and others of importance.

All of which may well be considered a forerunner of diplomatic recognition at Washington—a topic that is again being discussed in the newspapers.

A New Fasting Cure

THOSE of us who are troubled with a superabundance of this "too, too solid flesh" need no longer rely solely upon the tender ministrations of George Washington Hill, with his dietetic categorical imperative to "Cut out the sweets—reach for a Lucky." For their special benefit has been devised a series of fasting clubs, organized for world-wide regeneration, by George Huntly Aron, Master of Arts, and Doctor of Philosophy.

Dr. Aron has as his tripartite purpose the regeneration of the world with advertising of fasting knowledge as an act of philanthropy, the provision of free facilities for such fasting in Chicago as an additional philanthropy, and the regeneration of himself and his associates, to the end that they may the better act as free instruments of God in the new civilization that is at hand.

As one of Dr. Aron's most famous aphorisms is to the effect that "There is only one unforgivable sin, and that is not to tell your fellowman fully what you know of fundamental truth, but hoard it, or sell it to the most money-profitable market," it would seem highly improbable that this will be found to be but another smoke screen for the sale of cigarettes or other form of commercial activity.

Indeed, if full advantage be taken of the published works of his list of collaborating authors, those sufficiently interested in this new cult ("Gutella" by name) to make use of the available collateral reading may, after regaining their youthful "figgers," browse among the helpful pages of such gems of literature as "Methods and Uses of Hypnosis and Self-Hypnosis," "Hindu Magic," "Handcuff Tricks," "Vitality Supreme"—to say nothing of that perennially fascinating topic, "Womanhood and Marriage."

United Vegetable Growers Can Serve Both Farmer and Industry

IT IS TO BE HOPED that the recently announced $50,000,000 corporation known as the United Growers of America, Inc., will develop into a financially and morally responsible business organization. Those members of the food-manufacturing fraternity, particularly the ones who are purchasers of tomatoes for the manufacture of pulp, catsup, chili sauce, and canned tomatoes, will welcome an opportunity to deal with a single responsible selling agency—but it must be responsible in every sense of the word.

As conducted at present, it is necessary for most large tomato buyers to deal with a large number of individuals who may vary in their responsibility from sheer rascality up to the highest integrity. In the eastern part of the country, particularly in Maryland and in New Jersey, the practice frequently is to purchase tomatoes on the open market, but throughout the rest of the country the custom has, in general, been to deal with a host of growers who contract to provide all of the tomatoes produced from specified acreages.

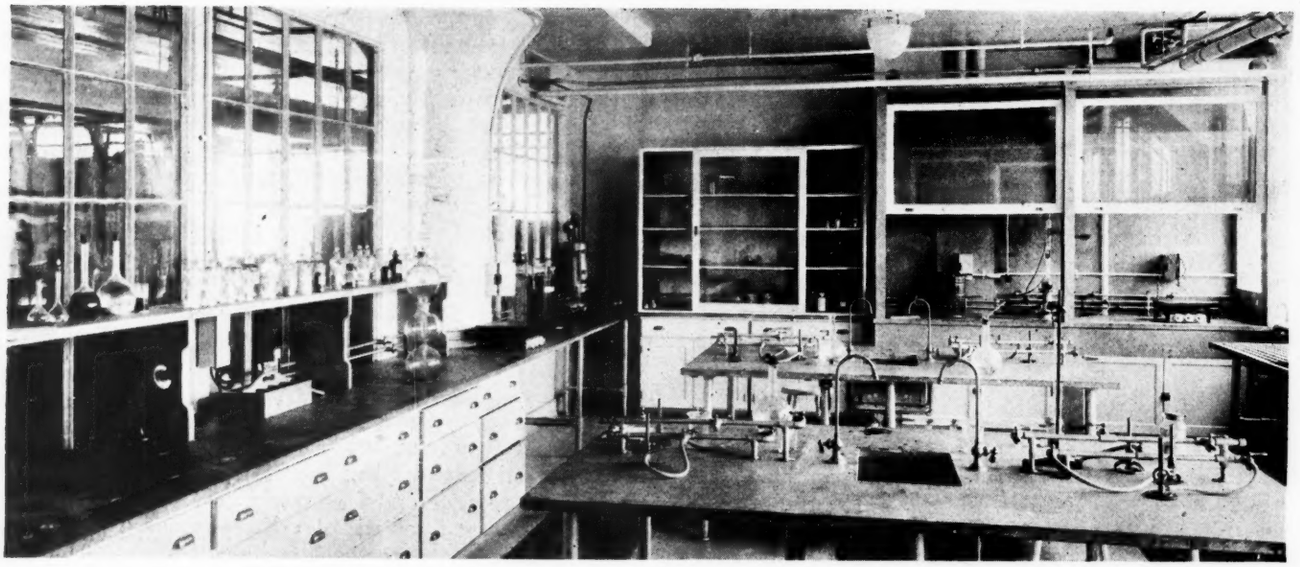
It will be readily seen, however, that if the canner or catsup maker can deal entirely with co-operative growing associations, and enter his order, for example, for 5,000 tons of tomatoes, all of which are to conform to U. S. No. 1 grade, how much simpler his business will be and how much cheaper his manufacturing operations can become. The important proviso, however, is that the growers' association must be financially and morally responsible. No more important work can be accomplished by either the Federal Farm Board or the United Growers than to sponsor and foster this development of reliability of character on the part of the smaller co-operatives under whose protecting direction they should now come.

Admittedly one of the lesser outlets, it can be made mutually profitable to interested growers and manufacturers and deserves support and the sort of co-operation that is inherent in proper direction.

Shall Food Advertising and Tobacco Be Regulated?

RADICAL provisions for governmental regulation of all food advertising are a part of a bill now before Congress. This rather startling amendment to the Food and Drugs Act is proposed by Senator Reed Smoot, of Utah, as a part of a measure which has also the purpose of placing tobacco and tobacco products under federal regulation like that to which foods and drugs are now subjected. We gravely doubt whether this bill, or anything very similar to it, will be enacted by Congress. But some queer things are done by that august body, and it is worth while to consider, therefore, what this bill might mean if it became law and what is the proper attitude of the food industries toward it.

The food industries have a direct interest in the question of regulation of food advertising by federal officials. Authority to do this might restrain some of the over-zealous, and certainly it would put a much-needed curb on some extravagant and unwarranted claims made in food merchandising. FOOD INDUSTRIES doubts, however, whether the food and drug officials are the logical agency to exercise such supervision. There already exists in the law establishing the Federal Trade Commission ample authority to prevent unfair trade practices through any extravagant advertising which is not in accord with facts. Better procedure than that suggested would be for advertisers and publishers alike to clean up their own business. This is the day of self-control in industry. Food manufacturers cannot afford to exaggerate or to tell anything but exact truth in their advertising. Obviously, there is no need for such legislation as is proposed by Senator Smoot if each advertiser, advertising agency, and publisher will but make an honest effort to use only straightforward, truthful propaganda. Such a plan would have the cordial support of the present federal administration, which, under the leadership of Herbert Hoover, stands unequivocally for the theory of "Self-Regulation of Business."



Typical chemical laboratory for analytical control of modern edible oil refinery

Present Day Manufacture of VEGETABLE OILS

By ALAN PORTER LEE

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New York City

FEW Americans, not excluding many of the largest consumers of the industry's products, realize the size and importance in our national economy of the manufacturing groups which produce, refine, develop and distribute the vegetable oils and fats that make up what appears at first glance to be a relatively small percentage of our diet. An examination of the situation, however general its observations and conclusions may be, will reveal that the total amounts of these products consumed by more than 30,000,000 families in the United States are capable of description only in terms of billions of pounds or hundreds of thousands of tons.

The uses of vegetable oils and fats in our kitchens and in the kitchens of our hotels, restaurants and bakeries are many and varied, but these uses may be classified into three general groups: shortening of bread, cake and pastries; frying, broiling and roasting uses; uses in the preparation of salad dressings and sauces.

For the satisfaction of the consuming demand for vegetable oils and their products for these purposes there are produced annually in the United States over one billion five hundred million pounds of cottonseed oil, one hundred million pounds of corn oil, one hundred and fifty million pounds of coconut oil, fifteen million pounds of peanut oil, ten million pounds of soya bean oil and a million pounds of olive oil. The total consumption is swelled by annual imports of approximately one hundred million pounds of edible olive oil, an additional hundred million pounds of coconut oil for edible use, fifteen million pounds of soya bean oil, five million pounds of peanut oil and ten million pounds of sesame oil. All of these imported oils, with the exception of edible olive oil, are brought into this country in their natural or raw state, just as expressed from the oil-bearing seed or fruit, and are refined and developed into finished edible products in American manufacturing establishments.

Up to the time of the Great War, the fats used in making margarin were approximately two-thirds of animal origin and one-third from vegetable sources. At present the relative figures are the other way round, about 66 per cent of commercial margarin being vegetable oils. Of these, coconut oil, rather than cottonseed oil, is most used by margarin manufacturers.

Exports of edible vegetable oils, the bulk of which are shipped to Canada, Mexico and Cuba, total approximately eighty million pounds annually. Subtracting this amount from the totals of production and imports will show

that the American public consumes, in one form or another, approximately one billion nine hundred and twenty-six million pounds of edible vegetable oils annually, or about sixteen pounds per capita. The wholesale value of these products will total over a quarter of a billion dollars and the retail value over four hundred millions.

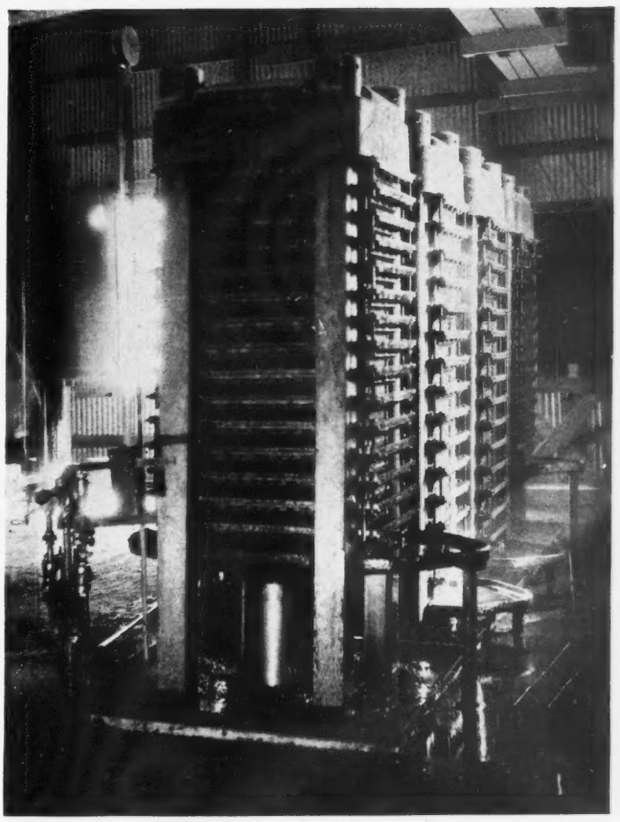
Here is a great industry, serving to supply a very definite, well-established public demand, but the most interesting thing in connection with the situation lies in the fact that no more than sixty years ago neither the industry nor the demand was existent. Olive oil, of course, has been a world staple for thousands of years, and in all that time has been the main dependence for fatty food of that section of the world known as the "Cradle of Humanity"—i.e., those parts of Europe, Asia and Africa bordering upon and adjacent to the Mediterranean Sea.

The peoples of the more northern zones of climate, however, have always relied more upon the fat of animals, milk fat or body fat, or both, to supply energy and bodily warmth, the furnishing of which is the chief function of fats in the human diet.

The vegetable-oil producing and refining industries have won their place in our scheme of life only through the progressive application of modern methods of production control and quality standardization and through constant stimulation of demand for their products by campaigns of educational advertising calculated to acquaint the public with the true worth of properly refined and developed vegetable oils as foodstuffs of prime importance.

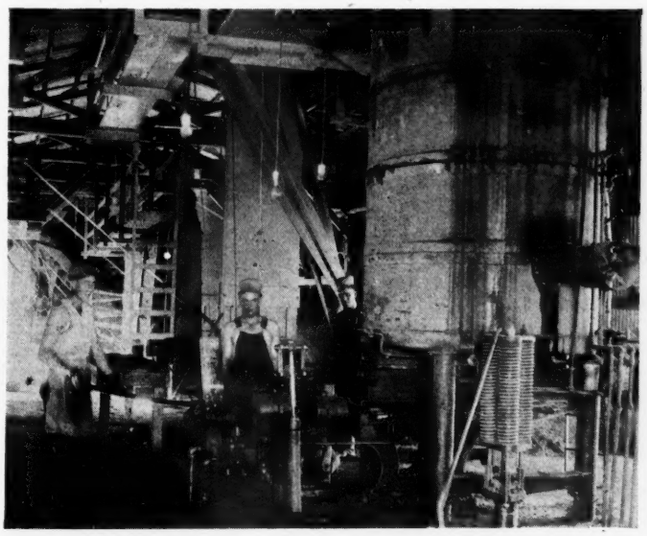
As stated above, sixty years ago this great industry was unknown in this country. It found its genesis in the cotton fields of the South when the planters and cotton ginners sought some means of utilizing the annual surplus of cottonseed, the disposal of which, with the steady growth of the cotton crop, became a serious problem. Concentrated efforts by engineers and chemists brought the discovery that instead of being a worthless nuisance, the cottonseed contained a valuable oil which, with proper refining, is suitable for practically all cooking, baking, frying and salad-oil uses.

This discovery was destined, eventually, to play a definite rôle in the production of a major change in the food habits of the nation. Prior to its occurrence, the American home had relied entirely upon animal fats for cooking and shortening purposes and upon imported olive oil for such salad dressings as were required, although in those days the salad was far from being recognized by the general public as one of the most important elements in a well-balanced diet.



Battery of hydraulic presses in operation in vegetable oil mill

Interior view of cottonseed oil mill, showing cooking retorts, automatic cake-former, and (at left) hydraulic presses



In the early days of cottonseed-oil production in this country, its proponents made the mistake of marketing the product more or less as a substitute. The new commodity was so easily disposed of as olive oil, or admixed with lard, that it was deemed unnecessary to create consumer demand for cottonseed oil on its own merits. These conditions were changed, of course, by the passage of the Federal Food and Drugs Act, which requires that all food products entering into interstate commerce shall be truthfully labeled on their merits. This legislation has proved of the greatest value to the cottonseed-oil and other vegetable-oil producing and refining interests of the country, for it gives the public the opportunity to judge each product upon the basis of its own intrinsic worth, without false labeling or deception. That American vegetable oils have earned popular approval is fittingly shown by the annual production figures given above.

This approval has been gained only through painstaking application of scientific methods of control to the production, refining and manufacturing operations, with the result that quality of product has been steadily improved until it closely approaches perfection and is uniformly maintained at this high standard. By means of the same careful control of every production step, the costs of the various manufacturing processes have been progressively reduced, so that the American public

today is able to purchase oils of the finest quality at prices much lower than those paid for inferior oils in the early years of the American vegetable-oil industry.

The manufacturing operation of this great industry may be grouped readily into three major divisions: (1) the separation of the natural, or raw, oil from the seed, nut or fruit which bears it, which operation is generally described as oil milling; (2) the purification of the raw oils for the production of refined edible oils, known as refining; (3) the development of the refined oils into special products, such as salad oil, shortening, margarin, mayonnaise or French dressing.

These operations are very closely analogous in function to those necessary in the production of sugar. Nearly everyone knows that the first operation in the manufacture of sugar is the production of raw, or low-grade brown, sugar, which is conducted in the sugar mill, generally located near the cane or beet plantations. Similarly the first step in edible oil manufacture is the milling of raw oil from the cottonseed, corn, peanut, soya bean or coconut in which nature has developed it. Just as raw sugar contains small amounts of coloring matter, organic matter and ash removed from the cane or beet along with the sugar, so that the raw vegetable oil contains entirely similar materials removed with it from the parent seed, fruit or nut in the course of the oil-milling operations. The refining of the raw oil for the removal of these small percentages of foreign matter and the manufacture of pure high-grade edible oils may be aptly compared to the refining of raw brown sugar for the production of marketable white granulated and powdered sugars.

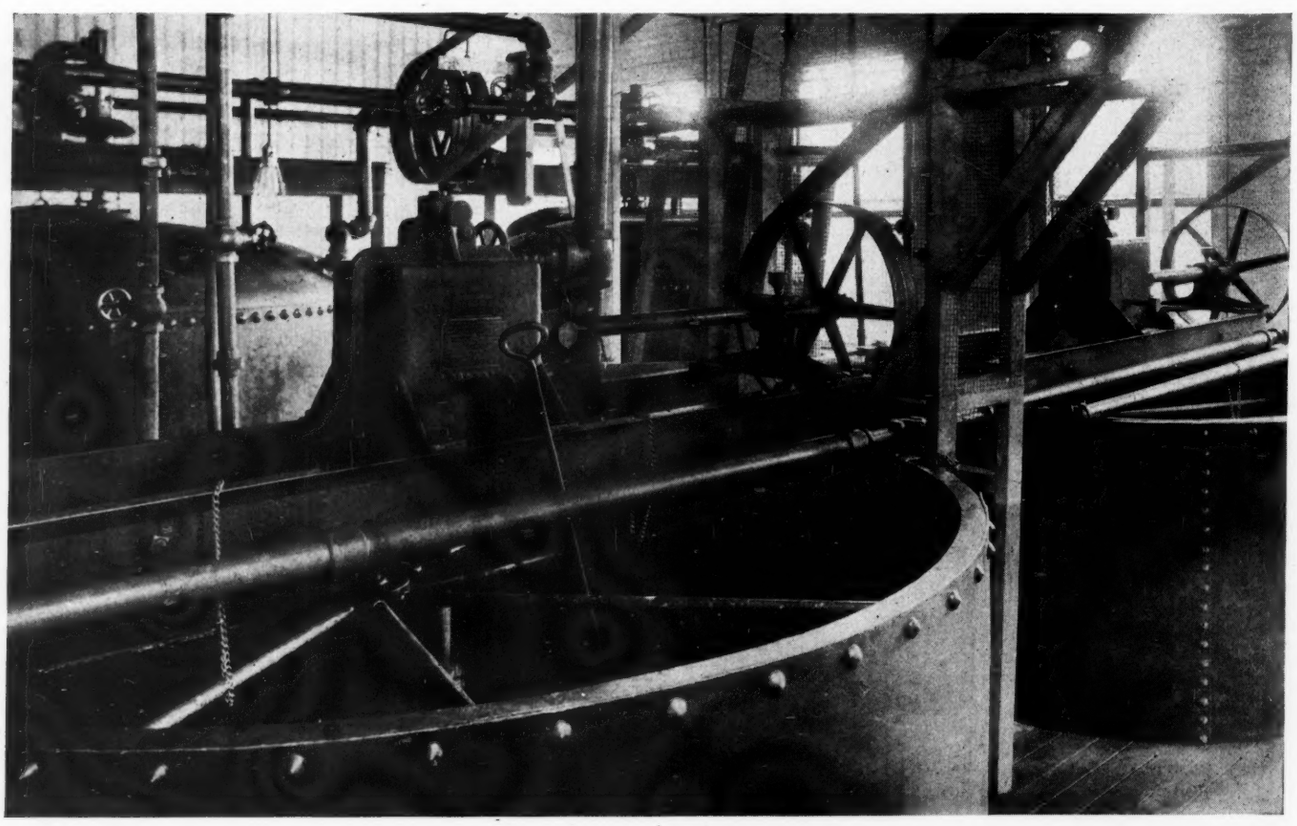
Pursuing the analogy, the further development of edible oils into salad oils, shortening, margarin and mayonnaise is carried out to meet the ultimate consumer-demand for staple foods in attractive packages and taste-tempting forms, and is comparable to the manufacture of loaf sugar, tablet sugar and candies from refined white sugars.

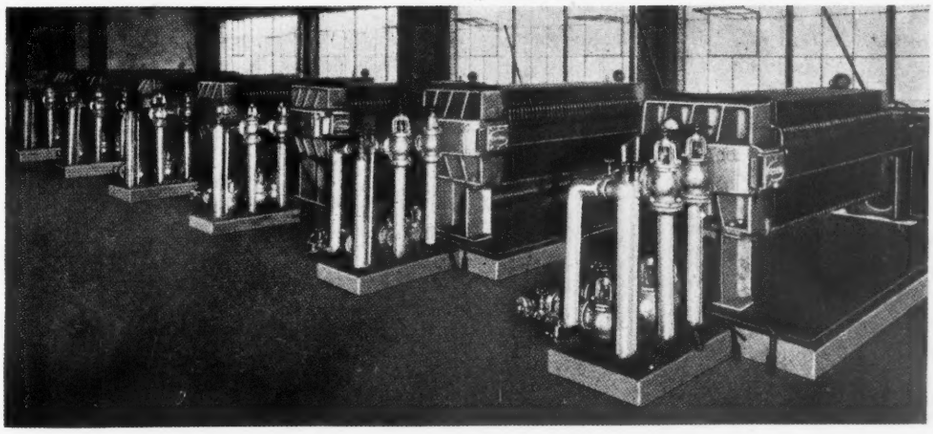
The first step in the manufacture of edible oils, the oil milling, is conducted, with only slight variations, according to methods and processes quite similar for every class of seed or nut comprising the raw material handled by the mills. The purpose of the operation is to obtain the highest possible yield of raw oil and, at the same time, a product which will be suitable for refining to the highest quality edible oil at the lowest possible operating cost. We will review the manufacturing methods in a cottonseed oil mill, as typical of the largest edible-oil-production industry in this country, noting that there is general similarity of procedure in the manufacture of the other raw edible oils.

The first step is the removal of the hull and, in the case of cottonseed, of the short cotton fibers known as linters, which are adherent to the hull. This separation is accomplished by a variety of machines, including delinters, hullers and separating screens. The application of scientific control begins with these initial operations, as the percentage yield of oil is susceptible to material reduction if the separation is inefficient—that is, if any material amount of the fibrous non-oily hulls and linters are permitted to travel with the meats (the oil-bearing kernels of the seed) to the actual oil-milling machinery.

After a preliminary cleaning of the seed, for the removal of sand and trash, and a magnetic separation for the extraction of nails and other bits of iron, the linters are removed by machines similar to cotton gins, consisting essentially of multiple circular saws revolving on a common shaft. Since the linters are sold for various purposes, including the manufacture of paper,

Washing and bleaching kettles in edible oil refinery





Installation of Shriver filter presses in a large edible oil refinery

of mattresses, of nitrocellulose and of rayon, the delinter saws are carefully adjusted to cut the fibers at the greatest possible uniformity of length. In the well-regulated mill, this operation is subjected to constant observation and control as are all the other steps of the processing. The efficiency of separation of the hulls and the kernels also is controlled by frequent analyses of each product for the presence of the other.

The kernels, or meats, when freed of the hulls, are ready for the actual oil-milling operation. They are first ground to a fine meal by passage through sets of steel rollers, then cooked with live steam in huge retorts, both of which treatments assist in breaking up the oil-containing cells.

From the cooking retorts the ground meats pass to machines known as cake-formers, where they are subjected to light hydraulic pressure, just sufficient to form them into cakes, without causing extrusion of the oil from the cells. Each cake is wrapped in a press-cloth of woven camel's hair and pressed under very high hydraulic pressure for the removal of the oil. The hydraulic press is charged with a number of cakes for each pressing. The oil flows through the meshes of the camel's hair cloth and down from the press to a reservoir below, where it is allowed to settle for clarification before shipment. The residual cake, after removal of the oil, is in considerable demand as a cattle feed, containing substantial protein values, and is sold for this use.

In the modern oil mill, scientific control has been applied for the standardization of each operating step from the cooking through the forming and pressing of the cakes, so that maximum yield and quality may be obtained. The cooking is controlled for temperature and time by thermostatic controls and automatic steam shut-off valves. The quantity of moisture in the cooked meats has been found to have a bearing on the subsequent processing, so this factor also is carefully controlled by frequent chemical analyses. The amount and duration of pressure in the actual pressing is governed by automatically operating hydraulic pressure valves. The residual cake from the pressings is analyzed daily for its oil and protein content, in order that the former shall be kept at a minimum and the latter as near as possible to the practical maximum.

The raw oil is analyzed frequently for quality and for comparison with the expected quality forecast by previous analyses of the original seed before processing. Any depreciation of the finished product from this forecast quality indicates, of course, some irregularity in the manufacturing process to be discovered and corrected. It is by such methods as these that our raw vegetable oils are produced at low cost and of uniform quality.

The refiner of edible oils, in spite of all the precautions of the miller, receives a raw product which, although high in quality, is still considerably less uniform than the raw materials of the sugar refiner. This is due to greater variations in seeds going to the oil mill than is found in sugar cane or beets. Another cause is found in the fact that most sugar mills submit their product to a slight refining process at the mill, whereas the raw vegetable oils are generally shipped in the condition in which they come from the oil press, to the refiner, who thus must bear the entire burden of preparing them for edible use.

Before considering the methods of operation and control in the modern edible oil refinery it will be advantageous to discuss briefly the composition of oils and fats. All vegetable oils—and animal fats as well—are composed of mixtures of substances known to chemist as glycerides. A glyceride is a chemical combination of glycerin and a fatty acid somewhat analogous to the chemical compound of sodium and chlorine which is common table salt. The glycerides in their pure state are colorless, odorless, tasteless products; but when found in oils in nature they contain small quantities of other organic matter originating in the seed in which the oil is developed. It is to these small quantities of organic impurities that each raw or natural oil owes its characteristic color, flavor and odor.

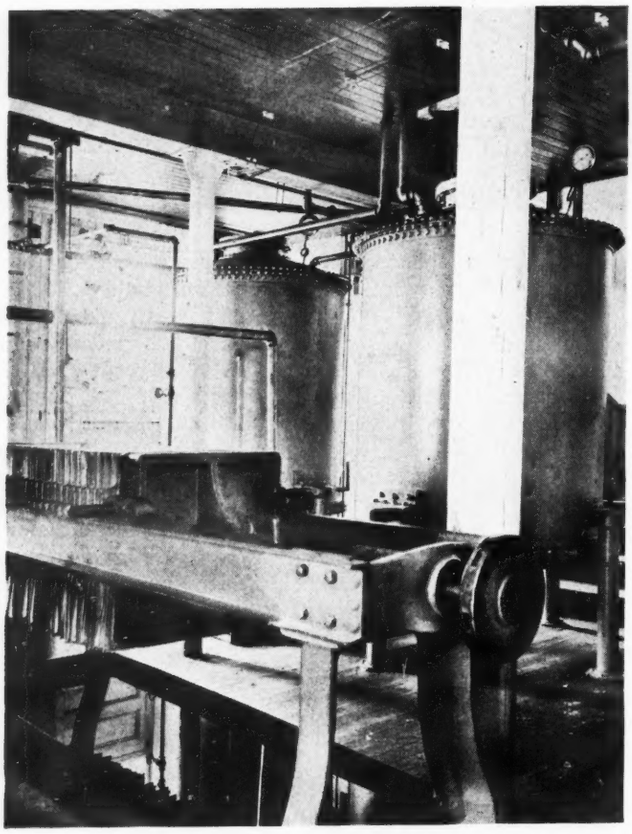
In the development of the seed kernel and also in the course of the oil-milling processes, a slight breaking-down of the glycerides occurs, forming small percentages of the two components: fatty acids and glycerin, uncombined with each other. These dissociated components must be removed in the refining process, as they are unstable in such free forms, and would cause rapid deterioration of the finished edible oil if permitted to remain in it.

The task, then, of the refiner of vegetable oils involves the removal of small quantities of various organic impurities and the production of a finished product which will be odorless, of a brilliant light color, and free from all flavors which are foreign to the inherent nature of the pure glycerides. This problem thus will be seen to be strikingly similar to that of the sugar refiner.

The first step in edible oil refining is the removal of the free fatty acids from the oil. This is accomplished by washing the oil with a weak solution of an alkaline material, which combines with the free fatty acids to form a definite water-soluble chemical product. The alkaline solution also reacts with a considerable

portion of the coloring matter and other organic impurities found in the raw oil, so that after treatment with this solution the oil is of lighter color, brighter, clearer and freed of uncombined fatty acids.

All of the compounds formed by the alkaline solution with the various impurities, as well as any free glycerin present, are soluble in water, so that they are found in the lower layer of water-solution, after the



Cooling and filtering equipment for final treatment of refined edible oils

oil and the solution in the mixture are allowed to separate, the refined oil forming a clear upper layer in the containing vessel. This refined oil is then washed with clear water to remove the last traces of the alkaline solution and the settling separation is repeated.

The oil is next treated with adsorbent materials, such as fullers' earth and activated carbons similar to the carbons used in gas masks. This treatment removes a further considerable portion of the remaining coloring matter, and is so conducted and controlled as to leave the oil at just the proper shade of color desired in the finished edible product. The adsorbent materials are filtered out of the oil by means of filter presses, which are designed for the efficient separation of any mixture of solids and a liquid on a large scale.

The final treatment of edible oils consists of a steam distillation operation in which the most minute traces of aldehydic and other volatile impurities are distilled out of the product in a current of steam at an elevated temperature. This operation is conducted in high-vacuum apparatus to facilitate the separation of the volatile impurities and to prevent injury to the oil by oxidation from atmospheric oxygen at the high temperatures necessary for the distillation. When the distillation operation is completed the oil is carefully cooled and filtered and is then ready for sale for edible purposes or for development into more specialized products, such as shortening, margarin, salad oil or mayonnaise. Of these, the topic of margarin manufacture was discussed in the July issue of Food Industries by H. W. Vahlteich.

The methods of scientific control which are applied in the edible-oil refinery are largely chemical methods, which are applicable at every stage of the refining process. Thermostatic control methods also are extremely valuable, because of the many temperature variations required during the course of the material through the various processes. The chemical analysis begins with the receipt at the refinery of the raw oil, which is analyzed for percentage of uncombined fatty acids and for other impurities, and is carefully tested in the laboratory to determine the most suitable strength and quantity of alkaline solution for use in the first washing treatment.

When this treatment is completed, the semi-refined oil is tested to confirm complete removal of the free fatty acids and to determine the optimum amount of adsorbent materials indicated for further color removal. Repeated observations of color and flavor, compared against standards, are made upon the oil at all the intermediate stages of the process, as are further determinations of traces of impurities, such as free fatty acids. Specific tests for rancidity or other deteriorations also are applied with frequency and regularity.

In the field of physical and engineering control methods, reference has been made to the application of thermostatic controls. These are applied to the water used in washing the oil and to the oil itself at many points, particularly in the bleaching and distilling operations. In the latter process, recording and indicating thermometers, vacuum gages and steam-pressure gages are considered essential, as uniformity of quality is subject to impairment by the very slightest of deviations from standard operating practice.

The methods of scientific control outlined above have been developed for the purpose of maintaining the quality of refined edible oils at a uniformly high standard. For the purpose of reduction and limitation of costs in the refinery operations, additional means of control are constantly employed.

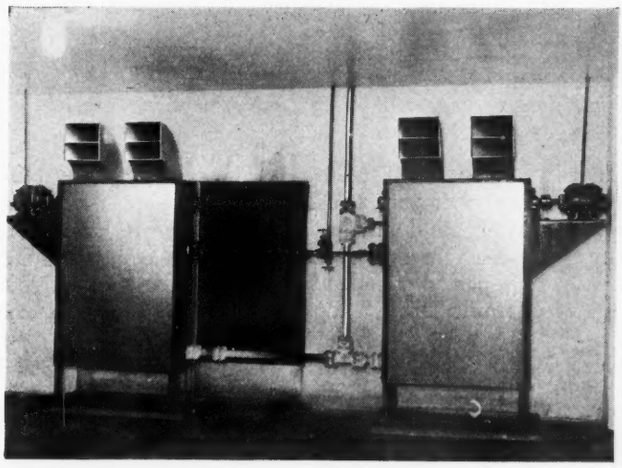
The primary object of such additional control methods is to prevent the loss of the valuable major product, the refined oil, in the less valuable byproducts. The alkaline solution which is used to combine with and remove free fatty acids is calculated of such strength and quantity that a minimum of the oil shall be absorbed in the washing operation, and the wash waters are constantly analyzed to insure their freedom from such absorbed oil. The adsorbent materials used in bleaching will necessarily absorb some oil, but the amount of this loss also is kept at a minimum by frequent analysis and control. The condensation products of the final steam distillation also are subjected to analytical observation to prevent losses of oil in this direction.

It is only by such constant vigilance in the application of modern methods of chemical and engineering control to their procedure that the vegetable-oil industries of this country have developed their business from nothing to its present magnitude within the comparatively short span of sixty years.

The further manufacture of refined edible oils into shortenings, margarin, and mayonnaise, which is characterized by similar strict adherence to scientifically controlled methods, will be discussed in future issues of Food Industries.

UNIT COOLERS

Show Savings in a Philadelphia Dairy



Portable, self-contained air-cooling units

By WILLIAM H. TIMM
Consulting Engineer and Architect, Philadelphia, Pa.

ACTUAL savings of 35 per cent a year on the cost of cooling milk were demonstrated by the use of unit coolers instead of the usual bunker coils in the milk storage rooms of a large dairy in Philadelphia. The test* was conducted in a plant in which five cooling units† had been installed to replace bunker coils when it was remodeled under the author's direction.

The cold-storage rooms, three in number, located on the first floor of the dairy, are adjacent to the outside loading platforms and communicate directly with the bottling and filling room. The inside dimensions of the two large rooms are 40x21 ft. and the smaller 20x21 ft., and all are 8 ft. high.

Insulation is cork throughout with 4-in. thickness in partition walls, floor and ceiling, and 5-in. thickness in the side walls. The outside walls are of brick construction, 13 in. thick, and the inner wall is 8 in. thick, with an enamelled brick finish on the filling room side. The floor is built up from a concrete slab with two 2-in. layers of cork in mastic, 1½ in. of cinder concrete, ¾ in. of sand and cement, and 1½ in. of packing-house brick.

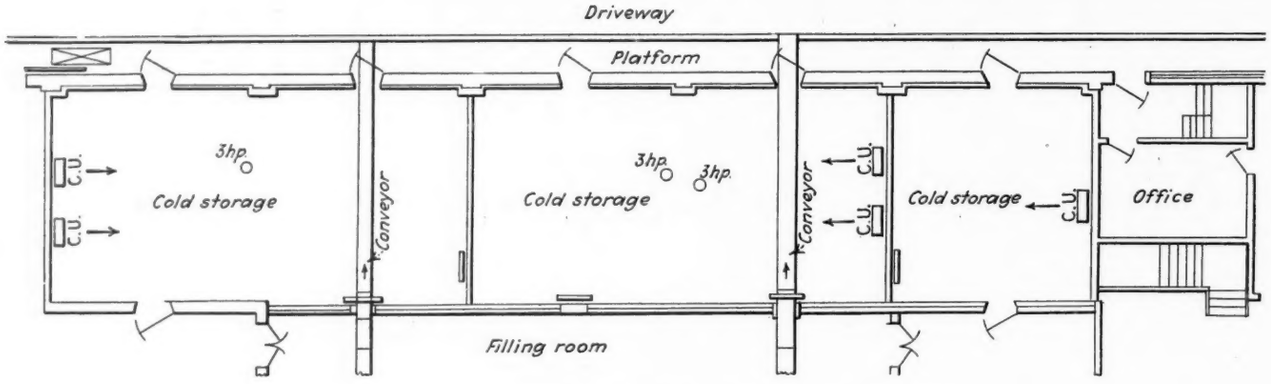
The cooling-room ceilings are suspended from the second floor beams on 2x⅝-in. steel hangers. Their construction includes two 2-in. layers of cork on the inside over a supporting ceiling of two ⅞-in. courses of planking, and separated from it by two layers of roofing paper. The cork is protected by an application of mastic plaster. Three refrigerator doors give access to the storage rooms and two small "passing" doors are provided through which milk may pass on gravity conveyors.

Cooling units were installed side by side at one end of each of the larger rooms. Each unit has a ¾-hp. motor directly connected to a fan which is rated to handle 3,000 cu.ft. of air per minute. The effective coil surface is 140 sq.ft. per unit, and the coils are held at a temperature close to zero F. by ammonia from a central plant.

That the subsequent figures may be interpreted by those engaged in this line of work, the operations are described in essential details. The two larger cooling rooms are used to store bottled milk prior to loading into wagons for local delivery. Dairy operations start at approximately 1 a.m., when the first wagons are ready for city delivery. Milk begins to arrive from the country at about the same hour and is immediately treated and bottled. The work usually is finished about 8 a.m., when all milk on hand has been bottled and either sent out for delivery or put into the storage rooms for later trips.

During the bottling and loading period cases of cooled and bottled milk are run down a gravity conveyor through one of the small doors to the storage rooms, and either conveyed directly to the delivery teams or placed in the cold-storage room ready for the next delivery. All conveyor and refrigerator doors are thus open throughout the entire loading period, and temperature inside the cooling rooms rises appreciably as a result. The maximum, on extremely warm days, is approxi-

*The test was carried out in collaboration with the A. C. Nielsen Company of Chicago.
†York Heating & Ventilating Company No. 1522 units were employed.



First floor arrangement of the dairy, showing cooling units

mately 60 deg. F., and it ordinarily takes from three to four hours to bring the cooling-room temperature back to the 33-deg. level normally held after all doors are closed for the day. No attempt is made to refrigerate the storage rooms during the loading period, and the cooling units are turned on only after traffic through the rooms has ceased.

The refrigerating load varies widely. The period of fan operation required to cool the rooms after loading is finished each morning is by no means constant, depending altogether on outside conditions and reaching its three- to four-hour maximum only when the cooling-room temperature has risen to between 55 and 60 deg. during loading. Room doors are opened at frequent but irregular intervals during the remainder of each day, both for loading out special deliveries and to permit access by the plant engineer, who maintains a close watch on room temperature by periodic readings of a thermometer suspended inside at the center of each room.

The cooling units are not operated at all, of course, when the outside temperature is at 40 deg. F. or below; a certain amount of temperature control is made possible at such times merely by the opening and closing of refrigerator doors. Experience to date indicates that fans on the cooling units will be operated for an average of approximately four hours a day for a period of 32 weeks (224 days) each year—a total of about 896 hours annually.

Alternative Cooling System

In planning the remodeling of this dairy estimates and calculations showed that one of three different types of more or less standard bunker coil coolers would have been required if that form of equipment had been selected instead of the unit cooler.

The simplest bunker coil system is the one employing natural air circulation exclusively, the cooled air settling in the center of the room and forcing the lighter warm air upward along the walls and across the ceiling to converge there for passage across the coils. The second system is like the first in most respects, but would incorporate a disk fan to blow air across the cooling coils and thus materially increase heat absorption per unit of coil area exposed. A third possible system—a direct outgrowth of the second—would use metal ducts to circulate cooled air over a single coil bank, distribute it to several rooms and return it, at somewhat higher temperature, to the coils. The cost of any one of these three bunker coil systems would be considerably more than for unit coolers of equivalent size and capacity.

The accompanying table presents a brief summary of general cooling-room and equipment data and shows a calculation of the annual charges for two unit coolers and for an equivalent bunker coil system. The original estimated cost of $1,900, shown for the latter, is 211 per cent of the actual expenditure for two cooling units.

Comparative Installation Data and Annual Fixed Charges on Unit and Bunker Coil Refrigerating Equipment for Milk Storage Room

General Data

Room dimensions:	Feet
Length	40
Width	21
Height	8
Cork insulation:	Inches
Partition walls, floor and ceiling	4
Side walls	5
Doors:	
Access—Loading platform side	2
Bottling department side	1
Conveyor—Bottling department side	2

Equipment Data and Costs	Two Cooling Units	Equivalent Bunker Coils
System considered		
Fan motors	2–¾ hp.	1–1 hp.
Motor operating schedule: Days per year	224	224
Average per hr.-day.	4	6
Fan rating, per unit	3,000 c.f.m.	.....
Effective coil surface, per unit	140 sq.ft.	.....
Refrigerant	Ammonia	Ammonia
Temperature carried: Coil surface	0 deg. F.	0 deg. F.
Inside room	33 deg. F.	33 deg. F.
Total investments, all equipment, installed	$900	$1,900
Annual Charges		
Depreciation—(twenty-year basis)	$45.00	$95.00
Average interest at 6 per cent	28.35	59.85
General repair and maintenance allowance including oiling, cleaning, and possible coil repairs	25.00	10.00
Power (estimates based on assumption of 80 per cent average load and 80 per cent efficiency): 1,000 kw.-hr. per yr. (same for both) at $.025	25.00	25.00
Totals	$123.35	$189.85

Net Annual Saving

Unit coolers	
Difference ($189.85—$123.35)	$66.50
Cost reduction, per cent	35

This figure is necessarily an estimate, but is based upon long experience with bunker coil installations and is known to be sufficiently accurate to assure fair and conservative comparison.

A life of twenty years has been used as the basis for depreciation and for average interest calculations in both cases. Bunker coils, particularly of wrought iron, are known to be capable of giving such service, and there is little reason to believe that the cooling units will not do equally well. For the sake of conservatism, however, they are given a general repair and maintenance allowance of $25 per year, whereas the other equipment is covered amply by an allowance of $10. This additional set-up of $15 per year will be sufficient to cover one complete replacement of the ammonia coils in the units if such a repair becomes necessary. Power costs have been estimated for both refrigerating systems on the motor sizes and fan duty previously outlined. The totals of all cost items are $123.35 and $189.85 per year, respectively, for unit cooler and bunker coil equipment.

The cooling units have several distinct advantages for the type of work here considered as compared with the alternative bunker coil system. Low costs are an important consideration. A comparison of the totals shown in the preceding section indicates a direct saving of $66.50 per year as a result of the employment of cooling units. This is a cost reduction of approximately 35 per cent, and it must be borne in mind that the original cost of the equipment was less than half of the probable expenditure for an equivalent bunker coil system.

Higher efficiency is the second major consideration. The advantage of the unit cooler in this respect results from the fact that air movement over the coil surfaces is both positive and rapid. Check tests run on the equipment soon after the installation got well under way showed a coefficient of heat transfer between 6 and 7 B.t.u., whereas the usual corresponding figure with bunker coil equipment is between 3.5 and 4 B.t.u. This means that the cooler coils absorb nearly twice as many units of heat per hour per degree of temperature difference, and explains why the calculation of power costs for the bunker coil system considered here is based on an estimate of six-hour operation each day, instead of on four hours, as is the case with the unit cooler. Available data do not warrant comparison of the two systems on the basis of total refrigerating cost, but it is obvious that the unit cooler has an advantage in this respect, if only because of the shorter period during which the compressor operates and refrigerant circulation losses need be endured.

Grape Products Industry To Stabilize Itself

THERE ARE in California approximately 20,000 growers of all varieties of table grapes, of which 13,000 control approximately 84 per cent of the total of 660,000 acres in bearing in 1928. About half of the acreage is devoted to raising grapes and the remainder to table and juice varieties. Production in 1928 was as follows: Raisins, dried, 255,000 tons; valued at $10,200,000; raisins, fresh, 301 tons, valued at $3,010; juice grapes, 472,000 tons, valued at $11,800,000; table grapes, 385,000 tons, valued at $10,010,000. It is estimated that $300,000,000 is invested in vineyards and $36,000,000 in the 400 bonded wineries in California.

Previous to the advent of prohibition in 1919 California juice-grape growers had 700 bonded wineries which practically absorbed the entire juice-grape crop. In December, 1919, with the outlet for the wineries limited to medicinal and sacramental purposes and with 30,000,000 gallons of wine on hand unsold, it was evident that most of the wineries were due to cease crushing grapes, and the juice-grape growers were a gloomy lot indeed. Then followed the extraordinary demand for juice grapes by the home vintner with consequent high prices that reached $65 a ton. This condition persisted up to about 1922, when prices began to fall off and gradually slid downward to an average of $25 a ton for all varieties of table grapes in 1926. The situation became even worse in 1928, as the computation of the average price from the figures in the first paragraph shows. Juice-grape growers were the worst sufferers when the price dropped from $40 to $25 a ton, but all growers suffered losses, for 60,000 tons of raisin grapes, 75,000 tons of table grapes, and 18,000 of juice grapes with a value of approximately $2,940,000 at 1928 prices, were left in the vineyards, unharvested.

To extricate the industry from its predicament the Federal Fruit Stabilization Corporation has been organized by the California Vineyardists Association to operate under the provisions of the recently enacted farm relief act. Organized prior to the passage of the farm relief bill the Fruit Stabilization Corporation is the first group which will benefit from the $500,000,000 made available for loans to co-operative agricultural associations. The program planned by the corporation comprises: (1) Financing the marketing of crops for growers; (2) developing byproducts and marketing them; (3) purchasing and shipping fresh grapes in order to control the trend of supply and demand in the fresh grape markets; (4) purchasing the entire raisin crop beginning in 1929 on a three-year contract basis.

Taking up the fourth point of the program first, the corporation will purchase outright the entire California raisin-grape crop at a price of 3½c. for Thompsons and Sultanas in 1929, 3¾c. in 1930, and 4c. in 1931. Prices for Muscats over the same period will be 4c., 4¼c. and 4½c., respectively. It is planned to dispose of raisins to the Sun-Maid association or to any other responsible packer whose credit enables him to make a three-year contract with the Fruit Stabilization Corporation.

Disposing of Muscat grapes as raisins is expected to reduce the shipment of this variety to the fresh markets by nearly two-thirds of the usual number of cars. Such Muscat shipments as can be absorbed by the fresh grape market at a profitable price will be released as fresh fruit. It is hoped by this means to obtain much higher prices for other table and juice varieties.

The fresh grape grower is asked to share in the corporation's program by a purchase of "Participation Certificates" for which he pays 2c. per package on all white juice grapes and 3c. a package on all black juice and table grapes which he may ship to the fresh-grape market. Funds obtained in this manner will be used to carry a proportion of the overhead cost for the raisin-grape purchases and to provide for the activities of the Fruit Stabilization Corporation in sustaining a fresh-grape

market. The subscriptions also represent a foundation for loans to be obtained under the farm relief act. Later on it is hoped to refund all of this money out of the profits of the corporation's activities, but even if this is impossible it is expected that the growers will be amply repaid by better prices in the fresh market, increased value of their land, and the surety of their credit.

A grape products conference was held on June 14 and 15 at the University of California at which 30 papers on grapes and by-products were read. Among the products discussed were grape concentrate for beverage and fountain use, table and industrial sirups, frozen grape juice and grapes, fruits canned in grape juice and grape sirup, powdered grape juice, grape vinegar, chief by-products and grape candies.

The Fruit Stabilization Corporation's program for by-products has included the merger of eight companies to be known as Fruit Products, Inc. The total valuation of the eight companies is approximately $30,000,000 and they include most of the California manufacturers of grape products. They are the Italian Vineyard Company, with plants at New York City, New Orleans, Los Angeles and Guasti, Calif.; California Grape Products Company, New York City, Delano and Ukiah, Calif.; California Wine Association, San Francisco and New York; Unity Grape Corporation, Lodi; Garrett & Company, with plants in southern California, New York and Missouri; Colonial Grape Products Company, St. Helena, Napa and Elk Grove, Calif.; National Fruit Products Company, with plants in Chicago and Lodi, and B. Cella, of New York and Lodi.

By controlling the raisin situation the grower will no longer be subjected to annual fluctuations in prices, and by co-ordinating the manufacture of byproducts and controlling the distribution of fresh grapes it is expected that a tremendous influence will be exerted on the whole grape situation this fall.

It is planned to request of the Federal Farm Board $25,000,000 with which to pay the full price value to grape producers this year instead of the 75 per cent cash on delivery payment originally planned. It is expected this year to give attention mainly to the grape industry but ultimately the corporation expects to represent in its membership deciduous fruits as well.

Lloyd F. Tenny is president of the Federal Fruit Stabilization Corporation and T. T. C. Gregory is chairman of the board of directors. Mr. Tenny was formerly chief of the Bureau of Agricultural Economics of the U. S. Department of Agriculture and joined the California Vineyardists' Association a year ago. Mr. Gregory is a San Francisco attorney and is general counsel for the Associated California Fruit Industries, Inc., of San Francisco. Members of the Board of Directors include J. L. Nagle, general manager of the California Fruit Exchange, Sacramento; Lucius Powers, owner of the L. Powers Fruit Company, Fresno; A. Emory Wishon, general manager of the Great Western Power Company, San Francisco; Roland E. Fontana, the largest grape grower in California, San Francisco; Scott F. Ennis, president of the Pacific Fruit Exchange, San Francisco; Harry M. Creech, president, Sun-Maid Raisin Association and Sunland Sales, Fresno; Paul Shoup, president of the Southern Pacific Company, San Francisco; Donald D. Conn, managing director, Associated California Fruit Industries, Inc., San Francisco; J. M. Leslie, president, Sun-Maid Raisin Growers of California, Fresno; Walton N. Moore, president of Walton N. Moore Company, San Francisco; and R. J. Senior, chairman, agricultural committee, Fresno County Chamber of Commerce, Fresno.

Jellifying Power of Pectin Depends on Reaction with Acids

AT THE annual meeting of the Society of German Chemists held in Breslau recently, the topic of pectins was the subject of a talk by Professor Ehrlich, of the University of Breslau. He portrayed the wide significance of these substances in plant life and reported the work he had done on their complex structure. As an essential constituent of the cellular plant substance, pectins are important in several technical processes, e.g., sugar industry, tobacco fermentation, flax, and so on. They have developed an importance likewise through their property of forming gels; many factories are now making pectin for the food industries from waste fruit products.

It is possible, that through a better and more complete knowledge of its chemistry, further food and non-food uses for pectin will be developed.

Chemically, pectin has as its main constituent a high-molecular ester-acid called pectic acid. This was isolated both from the sugar-beet and the rinds of oranges, and gives the empirical formula $C_{41}H_{60}O_{30}$, of which the greater fraction was d-galacturonic acid, produced for the first time in crystalline form, and now recognized as a widely disseminated plant acid. It is present in the original pectic acid as a methyl ester, in quantities of about 68 per cent. Pectic acid is subject to structural changes, however, under enzymatic influences, as well as in its extraction.

When the hot acids of the fruit react upon pectic acid during extraction they cause partial hydrolysis and release carboxyl and acetyl groups, while the galacturonic acid constituent becomes enriched. This explains the higher galacturonic acid content of the more easily jellifying fruit juices and the commercial pectin preparations. The power of one of these preparations was so great that 3 grams jellified 250 grams of water instantly and, in general, this power varies very much according to the galacturonic acid content.

The influence of enzymes on pectins was also studied. In takadiastase an enzyme was found which converts the insoluble plant pectin into water-soluble hydratopectin, and another enzyme which converts arabin into l-arabinose. Of great significance is an enzyme called "Degelase" found in molds, which converts the jellifying ring-compound, tetra-galacturonic acid, into the non-jellifying open-chain acid and, under favorable pH conditions, breaks it further down to d-galacturonic acid.

In woody parts of plants, e.g., flax-stalks, peculiar converted pectins may be observed which have undergone partial conversion into ligninous matter during aging of the plant and are due to enzyme action. Ehrlich believes that other reasons point to the assumption that the lignin of a plant has developed from the pectin and that the humus acid of the soil has perhaps the same origin.

Experimental Work in the Processing of SHELLED ALMONDS

By W. V. CRUESS and ROY HENRY
Fruit Products Laboratory
University of California

OBSERVATIONS made in a number of plants show that there is great variation in methods of blanching, salting, and cooking almonds. The investigations reported in this paper were undertaken in order to determine the principles involved and establish the proper methods of applying these principles commercially.

Scalding Experiments—Shelled almonds intended for salting are first scalded in hot water so that they may be easily blanched, i.e., the skins removed by hand or by blanching rolls. In the smaller establishments the almonds are usually placed in boiling water for five to ten minutes and then blanched without draining. In some factories the scalded almonds are immersed in cold water to keep them in condition for blanching for a considerable time. The quantity of water absorbed by these methods is very large and the almonds may be considerably injured thereby.

In order to determine definitely the effect of the temperature on the time required for scalding, 200-gram samples of Nonpareil almonds, containing 4 per cent moisture, were immersed for different periods in 4,000 c.c. of water at the temperatures shown in Fig. 1. Immediately after removal from the bath the almonds were drained and blanched by hand. The times given in the curve (Fig. 1) are those at which 100 per cent of the almonds could barely be blanched by hand. They were not scalded long enough to permit effective blanching by machinery or commercial blanching by hand.

Below 170 deg. F. the time required for blanching was too long for commercial use. Above 200 deg. F. rapid dissolving of the coloring matter of the skins occurred, frequently causing darkening of the meats. These tests and numerous observations on other samples scalded experimentally and commercially indicated that a temperature of 180 to 200 deg. F. is best. Too low a temperature results in many insufficiently scalded nuts that must be sorted out and scalded a second time.

Nonpareil almonds, scalded 3 min. at various temperatures and quickly dried with a towel, were blanched by hand and ground for determination of moisture. As a check, similar lots were not dried with a towel. The results of these tests are given in Table I. The nuts contained 4 per cent moisture before treatment.

Table I—Effect of Temperature of Scalding Bath on Moisture Absorbed

Temperature Deg. F.	Per Cent Moisture Absorbed—Surface not Dried	Per Cent Moisture Absorbed—Surface Dried
160	7.68	7.56
170	8.97	8.18
180	10.30	8.58
190	10.39	9.50
200	10.60	9.97
212	10.99	10.80

The results given in Table II indicate the rate of absorption of moisture at 190 deg. F. The rate was most rapid during the first 4 min. when the moisture content reached 12.3 per cent while during the remaining 8 min. only 3.5 per cent additional was absorbed. Later observations proved that high moisture content of blanched almonds at the time of cooking causes them to be tough and greatly increases the percentage of split meats.

Table II—Rate of Absorption of Moisture During Scalding at 190 deg. F.

Minutes	Moisture—Per Cent	Minutes	Moisture—Per Cent
1	8.7	6	13.4
2	10.0	7	13.8
3	11.4	8	14.1
4	12.3	10	15.0
5	12.9	12	15.8

Prolonged soaking removed from 5 to 10 per cent of soluble matter, leaving the nuts tasteless and woody, and when cooked or dehydrated many were stained and badly shriveled.

Since the water used in scalding almonds should be used only once, in order to avoid staining of the meats by coloring matter dissolved from the skins and because a relatively large quantity of water is absorbed during scalding in water, comparative tests were made to determine whether scalding in steam could be substituted for scalding in water. Less moisture was absorbed but it was found that steam-scalded nuts had to be blanched at once or after a few minutes the skins stuck to the meats. See Fig. 2 for rate of moisture absorption.

Good results could be obtained if the almonds were soaked in cold water for 3 to 4 min. and then scalded in steam for about 3 min. Very little coloring matter was absorbed from the skins by cold water; hence the water used in treating the almonds could be used repeatedly. In commercial practice steaming and blanching could be made continuous operations. In order to keep the steamed almonds in good condition for blanching the conveyor to the blanching rolls and the rolls themselves could be inclosed and subjected to steam during operation.

Several experiments showed that scalding in steam

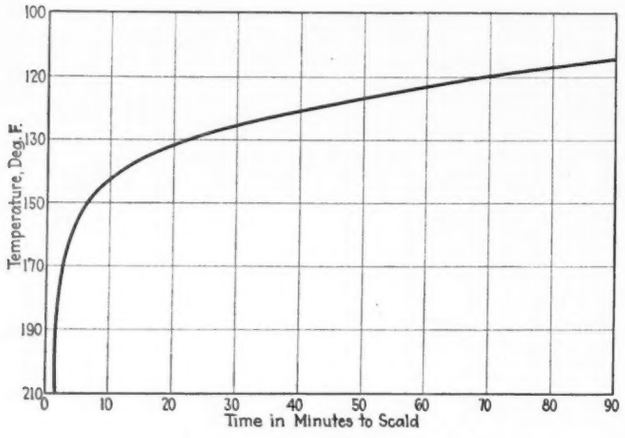


Fig. 1—Effect of temperature on time required for scalding almonds

under pressure gives a product of much more tender texture than that of water-scalded nuts. The color of the meats was darker, but nevertheless we believe this method has commercial possibilities.

It was found that soluble matter equal to 1.2 to 1.35 per cent of the weight of the almonds was dissolved by the scalding water during 4-min. immersion at 180 deg. F. However, the quantity of material dissolved varied considerably with the cleanliness of the almonds. In commercial scale tests 1 gallon of water to 1 lb. of nuts gave the best results.

Qualitative tests on the effect of the depth of the layer in the basket on the time required for scalding and on the quality of the nuts were made in a factory using the discontinuous basket method of scalding. The following tabulation gives the results obtained.

Test 1—Depth in basket, 10 in. Water, 212 deg. F. at start; dropped to 190 deg. F., again to boiling in 4 min. No stirring other than raising and lowering basket. Time, 10 min. Top layer of nuts, 12 per cent moisture; lower, 18 per cent. Scalding very uneven. Many stained, split and water-soaked meats.

Test 2—Depth, 10 in. Heating as in test 1. Stirred with paddle. Time, 8 min. Average moisture, 15 per cent. Many split, stained and water-soaked meats.

Test 3—Depth, 1½ in. Temperature throughout test, approximately 190 deg. F. Basket raised and lowered to stir. Time, 4 min. Moisture reasonably uniform at 11 per cent. Very few stained and split nuts; none water-soaked.

Test 4—Depth, 10 in. Initial temperature, 212 deg. F.; final, 160 deg. F. Results similar to those of test 1. Moisture, 14 to 19 per cent. Many split, stained and water-soaked meats.

Other tests were conducted in the laboratory with results similar to those obtained in the factory. Almonds should be scalded in a shallow layer with the ratio of volumes of scalding water to almonds large, in order that the temperature drop of the water during scalding may be small.

Qualitative comparisons were made of the corrosive effect of almonds on various metals during blanching. It was found that iron and steel were least affected; Monel metal and nickel were very slightly attacked; and copper, tin, zinc, brass and aluminum were actively corroded. Water extracts of skins and of blanched almonds were compared in respect to their action on metals and that from the skins was found to be considerably the more active.

Scalding was not uniform when the almonds were not agitated during scalding, as air entrapped by the dry nuts prevented uniform wetting. Agitation can be produced by raising and lowering the scalding basket or by very gentle stirring with a paddle.

In one experiment, weighed quantities of Nonpareil and Drake almonds were scalded for 5 min. in water at 190 deg. F. and the skins removed by hand, dried in vacuo at 70 deg. C. for 16 hr. and weighed. The Drake almonds showed losses of 4.46 and 4.49 per cent and the Nonpareils, 4 per cent. The average loss of soluble matter during scalding by approved methods usually was less than 0.5 per cent although when unduly prolonged it reached 1.5 per cent.

Experiments on the Dehydration of Almonds—Preliminary tests proved conclusively that the moisture content of almonds at the time of cooking in oil has a very pronounced effect on the toughness of the cooked product, high moisture content causing the cooked nuts to be tough and moisture contents of less than 2 per cent having no appreciable effect. Not only was the texture adversely affected by high moisture content before cooking but the flavor and color were similarly affected and considerable blistering and spotting occurred. These

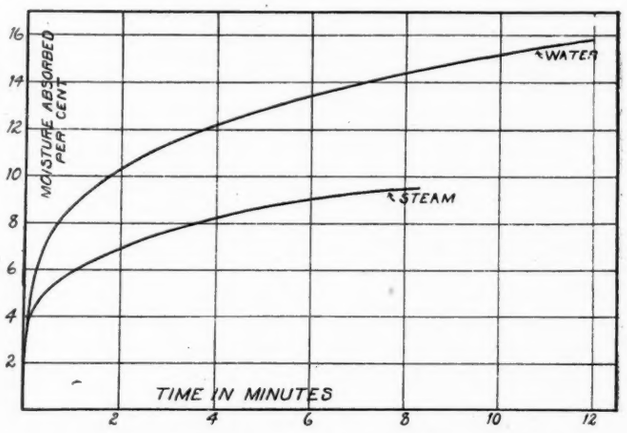


Fig. 2—Rate of moisture absorption by Nonpareil Almonds during scalding in water and steam

results were confirmed by similar experiments with a large number of samples. Nuts that were dried to a low moisture content kept much better after salting than those of higher moisture content.

Several trays of size-graded, blanched Nonpareil almonds were dried in the automatically regulated experimental dehydrator in the Fruit Products Laboratory at temperatures of 180, 170, 160, 150 and 140 deg. F. The air velocity, 750 ft. per minute, was the same at all temperatures. During dehydration the trays were weighed at regular intervals and observations were made

Sorting almonds, California Almond Growers Exchange

on the color of the meat near the center of the almonds. The nuts were analyzed for moisture content before and after drying. The rates of drying are indicated by the drying curves in Fig. 3.

At 180 deg. F. the interior of the nuts showed distinct browning after 6 hr. dehydration; at 170 deg. F. browning occurred at 10 hr.; at 160 deg. F. there was no browning in 20 hr., the duration of the drying period. It is believed that a temperature range of 140 to 150 deg. F. is the most satisfactory for factory use.

Qualitative drying experiments demonstrated that the relative humidity of the air at the hotter end of the dehydration should not exceed 10 per cent if the maximum rate of drying is to be maintained. The relative humidity of the air is most important near the end of the drying period when the nuts are nearly dry and give up their moisture slowly. The rate of drying is governed also to a marked extent by the rate of diffusion of moisture from the interior of the nuts to the surface. Possibly also some of the moisture is held in loose chemical combination and therefore is given up slowly.

Little difference in the rate of drying was observed with air velocities of 500, 750 and 1,000 ft. a minute. At 300 ft. a minute drying was considerably slower than at 500 ft. a minute. Under factory conditions a velocity of at least 500 ft. a minute should be maintained.

In the laboratory dehydration tests, drying was more rapid and much more uniform with a trayload of 1¼ to 2 lb. than with one of 3 to 4 lb. a square foot.

The time required varied approximately with the initial moisture content and seemed but little affected otherwise by the method of scalding. Prolonged contact with the scalding medium, however, resulted in some retarding of the drying rate, probably because of deeper penetration of the water.

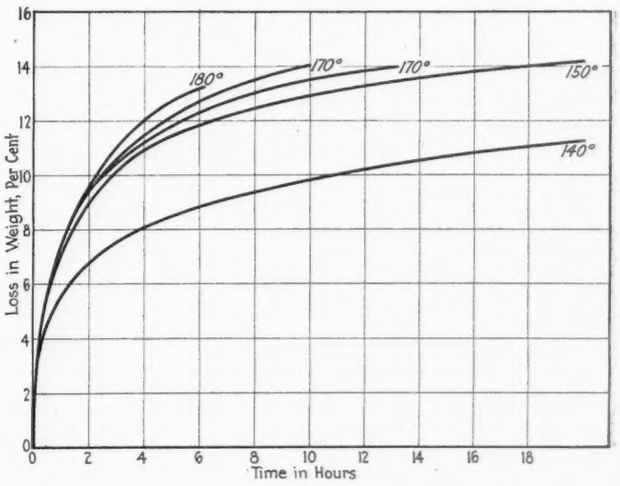
Drying of almonds in vacuo has been recommended by several manufacturers of dehydration equipment. Several lots of blanched Nonpareil almonds were dried in an electrically heated Freas vacuum oven under 26-28 in. of vacuum and several other lots were dried under 22 in. in a larger oven in which the nuts rested on a hollow metal shelf heated with circulated hot water. The rate of drying at any given temperature did not differ greatly from that at the corresponding temperature in the laboratory air blast dehydrator. While the quality of the vacuum-dried nuts was excellent it was no better than that of almonds of the same lot properly dried in an air-blast dehydrator. However, there was less danger of scorching in the vacuum oven near the end of the drying period.

It was observed that nuts allowed to stand moist for several hours after blanching were inferior in quality to those dehydrated immediately after blanching. If not dried promptly there was darkening of the surface and the almonds so treated were more susceptible to rancidity after drying.

Experiments on the Cooking of Almonds—In preparing salted almonds, the blanched almonds are first cooked in oil, usually refined coconut oil. The length of cooking varies with the variety of almond used, its moisture content and the color desired in the finished product.

Blanched Nonpareil almonds of 9 per cent moisture were cooked for various lengths of time in coconut oil with the results given in Table III. The time given in the table will not hold for all varieties and all conditions and must be varied with the moisture content and the

Fig. 3—The effect of temperature on the rate of drying of blanched almonds



time elapsing between blanching and cooking, for on prolonged standing the moisture penetrates deeply and is given up slowly during cooking.

Table III—Effect of Temperature on Time Required for Oil Cooking of Blanched Almonds

(not dehydrated before cooking)

	Time in Minutes to Cook at					
330–340	310	300	290	280	270	260	240
2–2½	3½	5	7	12	23	30	40

At 330 deg. F. and above the almonds cooked unevenly, and caramelized or "scorched" quickly. Above 300 deg., cooking was so rapid that great care had to be taken to avoid overcooking. Two hundred and ninety deg. F. for 7 min. gave the best results in these tests with freshly blanched, non-dehydrated almonds. At 260 and 240 cooking was extremely slow and the nuts tended to darken more than at higher temperatures in the time required to obtain the best texture. Furthermore, at these lower temperatures the nuts absorbed a large amount of oil and were thus wholly unsatisfactory for salting. Slightly shorter times were required for dehydrated almonds.

No exact time and temperature can be given to fit all conditions. The variety of almond, its size, moisture content and factors such as the ratio of nuts to oil, affect the time required to cook at a given temperature.

Blanched Nonpareil almonds, cooked at 300, 280, 260 and 240 deg. F. for various lengths of time, were placed at once in sealed jars to cool. Moisture was determined by the xylene distillation method. The rates of loss of moisture at various temperatures are given in Table IV. The rates of loss of moisture will vary greatly with the size of almonds used and the time between blanching and cooking in oil; therefore, the data must not be accepted as typical of all conditions.

Table IV—Effect of Temperature on Rate of Removal of Moisture From Almonds During Cooking in Oil

Time in Minutes	300 Deg. F.	280 Deg. F.	260 Deg. F.	240 Deg. F
0	9	9	8.2	8.6
1	6	8	...	...
3	2.5	5.6	...	...
5	1.8	3.8	...	...
6	...	3.4	5.6	...
8	...	2.5	...	6.4
20	...	...	3.4	3.8
35	...	...	...	3.3

The depth of nuts in the cooking basket was found to affect the results obtained as the following factory tests show.

Test 1—A cooking basket was filled to a depth of 8 to 10 in. with blanched, dehydrated almonds. Coconut oil was heated in a large kettle over a gas flame to 295 deg. F. The basket of nuts was immersed in the oil and the nuts cooked according to the regular factory procedure. The temperature of the oil dropped to 260 deg. F. and during the cooking period rose slowly to 280 deg. F. No stirring other than raising and lowering the basket was given. The cooking period was 10 min. The nuts near the bottom of the basket were badly overcooked, those at the center undercooked and those near the top properly cooked. Many of the nuts were oil-soaked. Their general appearance was poor and the flavor and color variable.

Test 2—The nuts were cooked as above for 8 min. except that they were stirred vigorously. While the quality of the cooked nuts was better than in the first experiment it was still very unsatisfactory.

Test 3—A layer of nuts about 1½ in. deep was placed in the basket and cooked for 7 min. The immersion of this smaller quantity of nuts caused only a small drop in temperature—to 290 deg. F. The cooked nuts were uniform in color, texture and general quality. This method is recommended, therefore, in preference to methods 1 and 2. These results were confirmed in tests on other methods of heating the oil and of temperature control.

Dehydrated almonds of less than 2 per cent moisture content were cooked for 7 min. at 290 deg. F. and then thoroughly drained to remove excess oil from the surface. The oil content of the various samples was determined before and after cooking with the results shown in Table V. The results were found to vary greatly with the quantity of oil allowed to adhere to the surface of the drained almonds. The tests indicate in a general way that approximately 2 per cent of oil is absorbed during cooking in coconut oil under usual factory operating conditions.

Table V—Increase in Oil Content During Oil Cooking

Variety	Oil Content Before Cooking	Oil Content After Cooking		
		Average	Minimum	Maximum
Nonpariel	56.21	58.61	57.02	60.18
Ne Plus	54.34	56.47	56.01	57.12
Drake	53.48	55.56	53.98	57.14
I.X.L	56.03	57.93	56.96	59.89

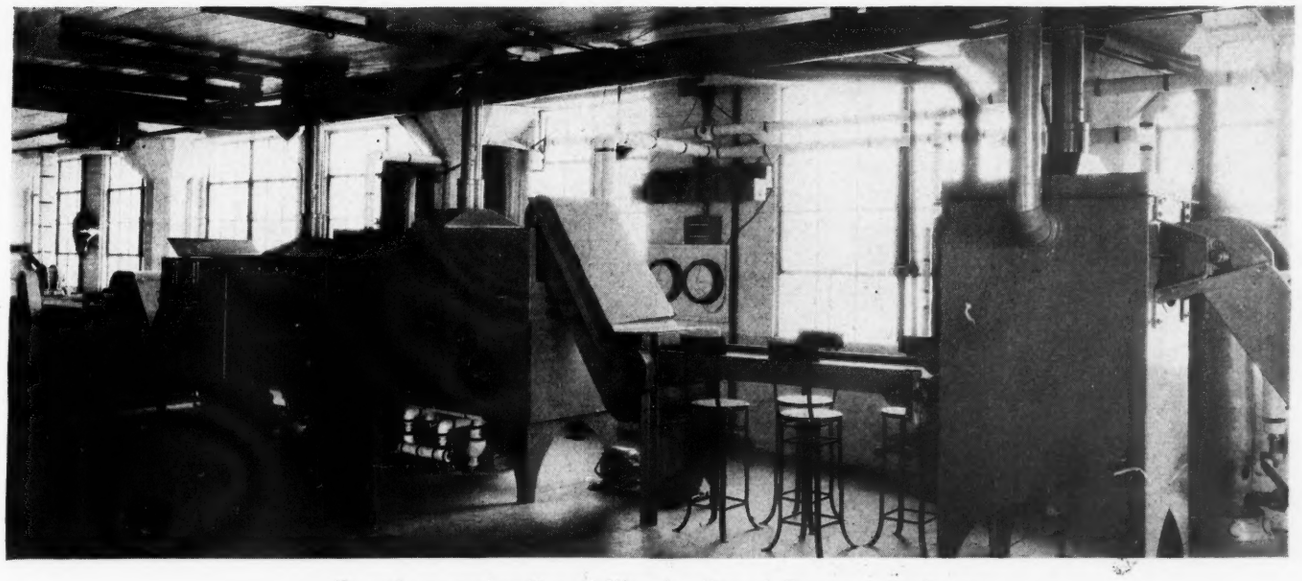
After removing from the hot oil, cooking continues unless the almonds are cooled. Probably one of the most satisfactory methods of cooling is by means of a downward blast of air, ordinarily obtained by a suction fan placed beneath the cooling screen. This method also removes excess oil and objectionable odors from the cooking room. In commercial cooking tests it was found necessary to stir the almonds to obtain uniform cooking; otherwise air pockets and uneven heating occur.

Qualitative comparisons of corrosion in coconut oil were made by suspending strips of metals in the oil at 300 deg. F. for 24 hr. Copper, brass and aluminum were heavily corroded. Tin, zinc and galvanized iron were corroded to a moderate degree, while iron, Monel metal and nickel were only slightly corroded. The surface of the aluminum became covered with an aluminum soap that distributed itself through the oil, rendering it unfit for cooking purposes and imparting a soapy taste to the nuts.

After cooking, in factory practice, salt is sprinkled over the almonds. Usually much of the salt does not adhere well and is lost because the oil used in cooking is absorbed and does not bind the salt tightly to the almonds. A special oil may be applied lightly to the almonds after they have been cooked and cooled (or partly cooled). Salt may then be applied. In salting experiments it was found that an oil melting at about 110 deg. F. gives better results than one of higher or lower melting point and better results than a water-soluble adhesive such as gum arabic.

In comparing various salts a reasonably fine-grained table salt ("medium grain") was found best for salting purposes. It must be free from magnesium compounds, as these give a bitter flavor. Approximately 2 per cent by weight of salt (when it is all held by the almonds) gives the best degree of saltiness. One of the best ways of salting is to apply the salt to the moist almonds immediately after blanching. Details of this method are given later in connection with the oven method of cooking almonds. When salted in this manner the salt is retained during subsequent oil cooking.

Comparison of Oven and Oil Cooking Methods—At the present time, in so far as the authors can ascertain, almonds are oven-cooked commercially only in the preparation of unbalanced roasted almonds and toasted



Almond processing line, California Almond Growers' Exchange

almonds. Both products are well browned and undergo a much heavier cook than is given almonds in oil for salting. It occurred to us that a light oven cooking of blanched almonds might give a product similar in color and texture to oil-cooked salted almonds.

Blanched Drake almonds and Nonpareil almonds were dehydrated to less than 2 per cent moisture and were cooked in a gas-heated stationary oven at 400 deg. F. for 10, 20, 30, 40, 50 and 60 min. Twenty minutes' cooking gave an excellent product, evenly cooked, of light amber color, crisp and tender texture, and of pleasing flavor.

The tests were repeated at 400, 350 and 300 deg. F. with blanched Nonpareil almonds that were not dehydrated before cooking. The highest temperature gave equally as good a product as the lower ones and required less time. At 400 deg. F. with a trayload of about 1½ lb. per square foot, 30 min. gave the best quality; at 350 deg. about 35 min. was required, and at 300 deg. about 45 min. The time varied greatly with the depth of the almonds on the tray and with their moisture content. It was found necessary to stir the nuts frequently in order to obtain uniform cooking. The Sunset Nut Shelling Company is now successfully applying this process and is well pleased with the product.

Determinations made at intervals during the cooking process showed that in most samples the moisture dropped to about 2 per cent at the end of the cook.

After one month's storage in loosely sealed jars in a warm room (70-75 deg. F.) oil-cooked almonds were decidedly rancid in odor and taste; while the oven-cooked almonds of the same lot were in excellent condition. Six months later, Oct. 10, 1928, the difference was still more marked; the oven-cooked almonds were still in good condition while the oil-cooked almonds were practically inedible. A few hours after cooking the almonds were judged by a number of persons and those that had been oven cooked were preferred by the majority.

New Salting Method—In conjunction with the oven-cooking method, a new salting process was devised. In present factory practice, salt is applied after the oil-cooking process; never before cooking. We found it difficult to salt oven-cooked almonds after cooking. The difficulty was solved by salting the almonds immediately after blanching. Approximately 2 per cent of salt by weight proved best. Ordinary table salt was sprinkled over the blanched almonds, which were then well mixed and placed in the oven. Much of the salt was dissolved and completely absorbed by the almonds; most of the remainder adhered to the surface.

Oven cooking should be less expensive than oil cooking in addition to its other advantages. The nuts need not be dehydrated before cooking; the cooking process requires a longer period and therefore permits of more accurate control; the moisture is removed at a moderate rate and finally, the oven-cooked almonds apparently are of much better keeping quality than almonds cooked in oil in the usual manner. We believe that the method can be readily adapted to factory practice.

Blanched, Dehydrated, Salted Almonds—It is customary at present to distribute shelled almonds to the confectionery, ice cream and baking trades in the natural state, or toasted, or as blanched, dehydrated meats. In our experiments two processes of preparing a fourth product, salted dehydrated almonds, were developed. This product does not require salting after oil cooking or oven cooking or toasting and makes an excellent dessert almond without further treatment.

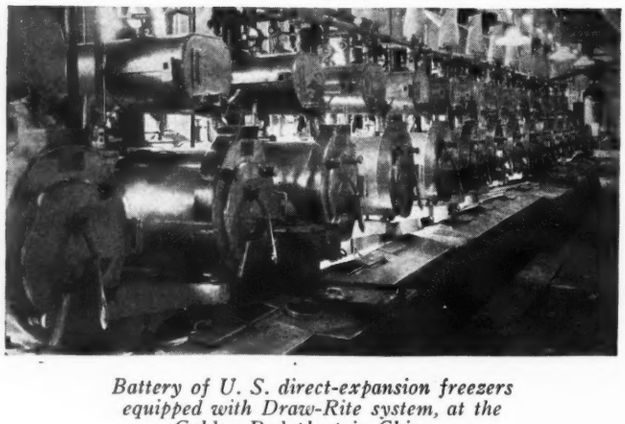
By one method of preparation the blanched almonds are boiled in a saturated salt solution for approximately 5 min. and the brine-treated nuts are dehydrated at 150 deg. F. to a moisture content of less than 2 per cent.

By the second method the nuts are blanched in the usual manner, 2 per cent by weight of table salt is added and thoroughly mixed with the moist nuts. The salted meats are then dehydrated at 150 deg. F. to less than 2 per cent moisture content.

It is believed that almonds prepared by either of these two methods would be very desirable for home use and the commercial trade, being very desirable for table use without further treatment. Having much better keeping quality than ordinary oil-cooked salted almonds, they should prove suitable for retail distribution in glassine bags, vacuum packed jars, and small tin cans.

The writers wish to acknowledge the co-operation and financial aid given by the California Almond Growers' Exchange, at whose suggestion these experiments were undertaken; also the Sunset Nut Shelling Company, of San Francisco, for materials used in some of the experiments.

SCIENCE *Leads Way in Development of the* ICE CREAM INDUSTRY



Battery of U. S. direct-expansion freezers equipped with Draw-Rite system, at the Golden Rod plant in Chicago

By W. H. E. REID
Professor of Dairy Manufactures
University of Missouri

THROUGHOUT the entire existence of the ice cream industry, and in the development of its various phases, science has played a most important rôle. The growth and expansion of the industry has been entirely dependent upon science to bring forth new thought and to assist in solving problems which appeared, at times, to be insurmountable.

About 1550 water ices are said to have been made by an Italian who established a famous cafe in Paris. Lemonade was originated about 1630. From water ices to mixtures containing milk and cream and eggs was apparently a logical progression, but history is really vague on the question of who first made ice cream.

The name ice cream is one of modern origin, the original terms being butter ice, or cream ice. Cream ice is said to have been known in Paris in 1774. A Frenchman, Clermont, gave instructions for making sweet ices in 1776. English books one hundred and fifty years old show recipes for cream ices in which cream and milk, sugar, eggs, and flavors were used. It is generally conceded that the Germans led the English in making fancy molded creams. History states that ice cream was first sold in New York by a Mr. Hall at 75 Chatham Street, now Park Row.

Jacob Fussell is admitted to be the father of wholesale ice cream business. To utilize surplus cream he conceived the idea of making ice cream. The House of Fussell was started in 1864 in New York City, and here the prevailing price for ice cream among confectioners was $1.25 per quart.

The real development, the day of large figures in the ice cream industry, had its beginning not over fifteen years ago. The rise and direct expansion of ammonia refrigerating systems for freezing this product efficiently has taken place only within the past few years. Today ice cream is no longer a luxury, as its lowered cost brings it within reach of the masses of people.

Frozen products are commonly classified according to the ingredients from which they are prepared, or the method of manufacture, or both. Plain ice cream is made of creams of different richness, sugar, flavor, and may contain a stabilizer. Eggs are not as yet generally used in ice cream and the products are only pasteurized. The simple flavors are vanilla, chocolate, caramel and maple. The fruit ice creams are strawberry, pineapple, cherry and raspberry. Nut ice creams include walnut, almond and pistachio.

French or Neapolitan ice cream is made from cream, sugar, eggs, flavor, and usually a stabilizer or gelatin. The ingredients are made into a custard, which usually is cooked and cooled before being frozen. It is in reality a frozen custard. The common French ice creams are termed custards, parfaits and puddings.

Fancy ice creams include various combinations of frozen desserts such as mousse, which is frozen whipped cream sweetened and flavored; bisque, a mixture of egg yolks, whipped cream, sugar and flavors. Sometimes a bisque is made by incorporating macaroons, marshmallows or sponge cake. Glace is prepared from whipped cream, egg whites, sugar and flavor.

Sherbets and ices have of late become notably popular and the result has been a marked increase in the volume of these products manufactured. Ices usually are prepared from water, sugar, flavor, and fruits, to which is added a stabilizer. Sherbets differ from ices in that they are made of milk or regular ice cream mixture and in addition may contain whites of eggs.

Years of diligent investigation have taught the ice cream manufacturer which ingredients, when used in desired quantities, produce a desirable ice cream, sherbet or an ice of different flavors. The task of the ice cream manufacturer, in making an ice cream of an unquestionable quality is one of the utmost importance because of the numerous problems which he must meet and overcome.

One of these problems, and as every manufacturer who produces a volume of ice cream of any consequence will openly concede, is to obtain ingredients which, when made into a homogeneous mixture, will produce an ice cream capable of assuring public satisfaction.

Manufacturers of ice cream are compelled to dispose of their product directly to a wholesale dealer within a limited distance from the plants or to retailers and consumers. Unlike the sale of milk powders, casein, butter and cheese, which may be held for long periods of time prior to their sale, ice cream usually is dispensed within 48 to 72 hours subsequent to withdrawal from the freezer. This procedure is made necessary because ice cream is a perishable product when exposed to the elements. Should the ice cream be manufactured from inferior ingredients, its life will be made shorter and may be measured by the quality of the products used.

Whole milk is one of the principal ingredients used in the manufacture of ice cream mixtures. The average composition of the milk should be 3.50 to 4.20 per cent butter fat and 8.9 per cent serum solids, or a total solid content varying from 12.4 to 13.20 per cent. Milk is used primarily in standardizing the high testing cream to the desired percentage of butter fat. The milk-solids-not-fat serve to give body to the ice cream, also fineness of texture, and aid in acquiring overrun.

The cream, like all ingredients used in the making of the ice cream mixture, must necessarily at the time received be clean, sweet, free from any undesirable flavors or taints, be smooth of body, have an acidity not exceeding 0.23 per cent by the acid test, and have a uniformly low bacterial count. Cream furnishes the major part of the butter fat and a portion of the milk-solids-not-fat to enrich the ice cream or sherbet by imparting a desirable flavor, also assuring smoothness of body and fineness of texture. The butter fat lends a true color and supplies fat which enhances the food value of the product.

Ice cream manufacturers of late years have accepted the use of condensed and evaporated milk products as being absolutely essential. The different kinds of milk from which a part of the water has been removed may be classed as evaporated, condensed whole milk, condensed skim milk and concentrated milk. The condensed milks may be either sweetened or unsweetened. Each form of condensed or evaporated milk furnishes a large amount of the milk solids, which when added improve the palatability of ice cream, give a smooth body and an improved texture. The flavor especially is improved when these products are added in correct proportions, as they encourage a blending of all flavors.

Whole milk and skim milk, in powdered form, are proving very popular with many manufacturers of ice cream. The outstanding advantage of using either whole or skim milk in this form is that the whole milk powder will furnish a large volume of butter fat and serum solids and the skim milk powder furnishes serum solids only. Neither of these products is perishable because the moisture content of each product does not usually exceed 3 per cent, although the whole milk powder may deteriorate after several months because of the possible oxidation of the butter fat.

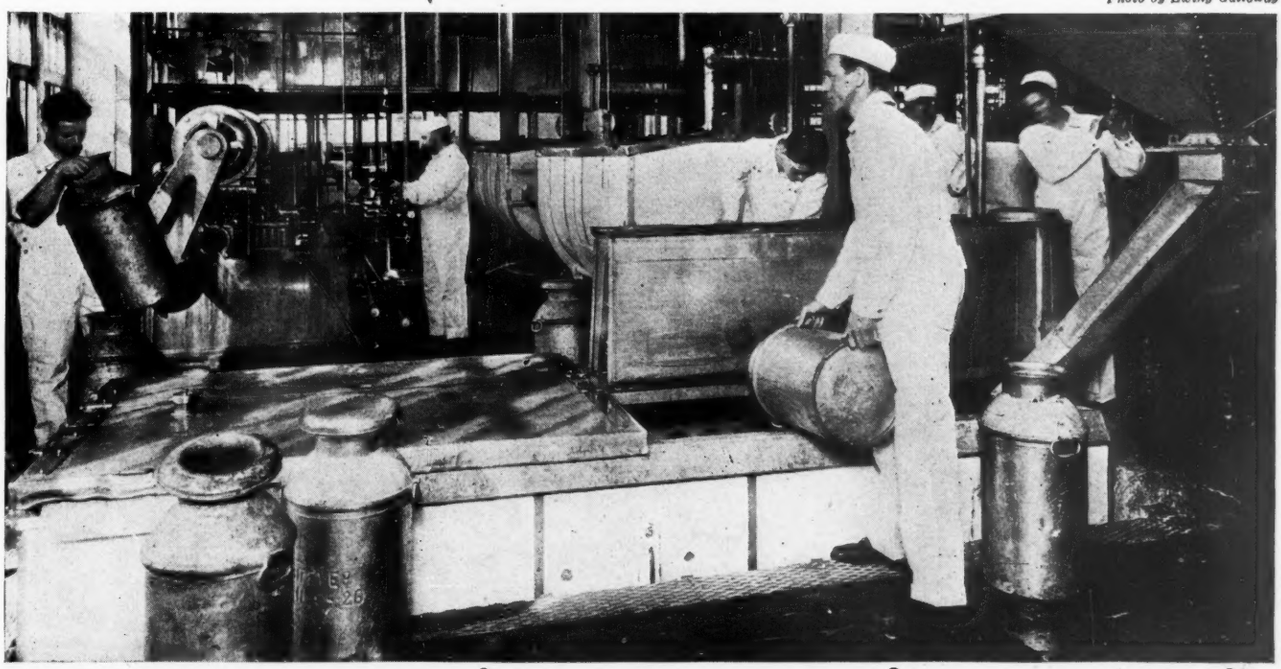
Butter is used in ice cream manufacture principally because of its high butter fat content and to meet unstable conditions in the sweet cream market. Butter is not nearly as perishable as sweet cream and its cost, based on a butter-fat basis, is much less than the average for sweet cream.

Stabilizers and binders are essential for the manufacture of a smooth ice cream. Without them the ice cream would be rough, grainy and coarse. They serve to retard the formation of ice crystals, increase the viscosity of the mixture and give stability to the finished product—that is, they assist in delaying the early melting of the ice cream. The most common of these products used are gelatin and gum tragacanth.

Innumerable different kinds of flavors, fruits, and colors are now used in ice cream manufacture. In order to meet present-day trade demands it is almost necessary that an ice cream manufacturer be equipped to furnish an ice cream, sherbet, ice or pudding of any color or flavor. The chief source of the sweetness for ice

Mixing room of the Breyer Ice Cream Company, of Philadelphia

Photo by Ewing Galloway



cream today is cane and beet sugars. The amount of each to be used is dependent upon trade demand.

The bacterial content of an ice cream is considered an accurate index of its freshness and of the care exercised in the production of the original ingredients. Knowledge relative to the care and application of sanitary principles during the process of manufacture also is disclosed. There are no definite bacterial standards for ice cream, although there is a trend in that direction at this time. The ultimate standards to be set up will undoubtedly be similar to present-day milk standards.

The bacterial content of the ice cream mixture and the resultant ice cream is that of the combined ingredients in addition to such conditions as may be due to air and contamination by contact with unsterilized equipment during the procedure of mixing, subsequent processing and freezing. Milk and cream are considered the principle sources of the total bacteria present in the mixture. All other ingredients add to bacteria count but are considered to be of minor importance in this respect. The equipment used for processing and freezing the ice cream mixture may be a serious source of bacterial contamination. The increase in the bacteria count due to homogenizing or viscolizing the mixture usually is the result of the breaking up of clusters of bacteria which may contain a dozen or more organisms. There is an unlimited opportunity for research in this particular phase of the industry.

Subsequent to mixing the different ingredients heat is applied and the temperature raised usually to 145 deg. F., and this temperature is maintained for a period of 30 minutes. The primary objective for heating or pasteurizing the ice cream mixture is to protect the consumer from possible harm that might be caused by the presence of pathogenic bacteria. A secondary objective of pasteurization is to retard bacteria development, thereby maintaining a low acid content. Should the acidity of the mixture become excessive the mixture would coagulate due to the action of the acid on the milk proteins. Undesirable flavor may become apparent also as a result of bacteria development and their ability to cause disintegration of the constituents of the ingredients.

When the mixture is heated to a temperature of less than 145 deg. F. the destruction of the bacteria is highly questionable due to their ability to withstand heat. There should be either a thermostatic control of valves or flow, with a recording thermometer so that the variation of temperature is never more than 3 deg. Pasteurization equipment that causes the formation of considerable foam should be avoided, as such foam may carry vast numbers of thermophilous bacteria—that is, bacteria which are unharmed through pasteurization.

The ice cream mixture is homogenized or viscolized for three definite reasons: first, to prevent partial churning of the mixture to butter in the freezer; second, to permit the use butter in ice cream as a substitute for cream; and third, to make the mixture homogeneous and acquire a mechanical viscosity.

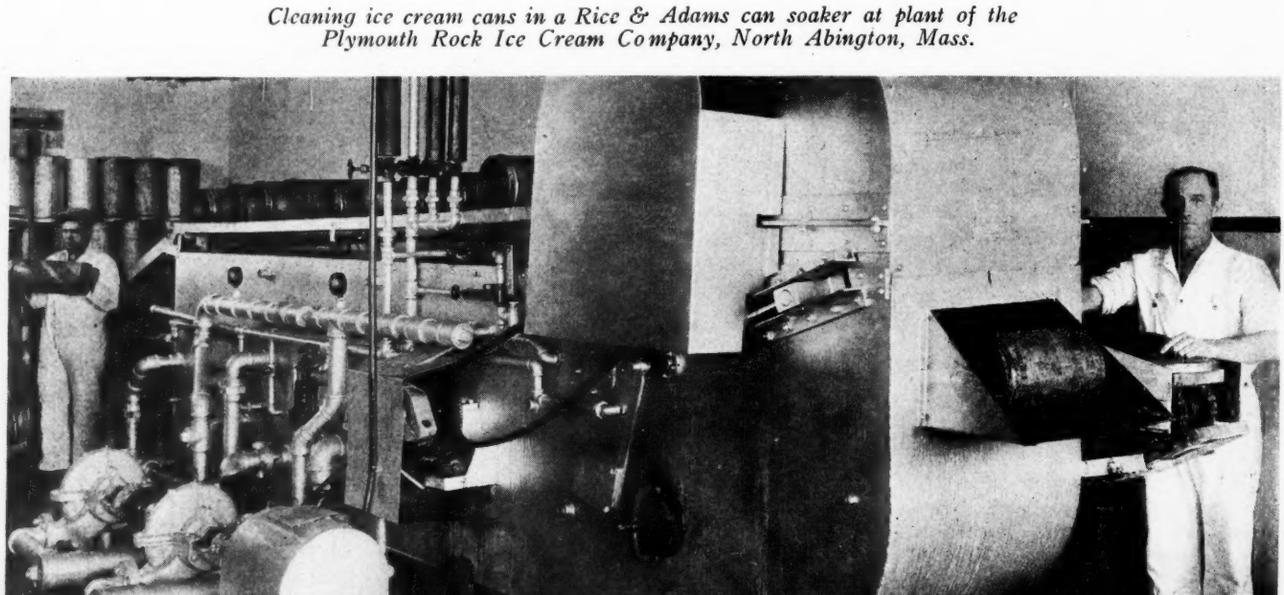
The homogenizer and the viscolizer function on similar principles, using a triplex or three-cylinder pump to acquire even, continuous pressure. This application of pressure forces the heated mixture through a minute aperture at a tremendous speed, reducing the butter fat globules, which originate in the cream and butter, to one-third or less of their original size. The butter fat and other solids as a result are distributed evenly and more permanently through the serum of the mixture.

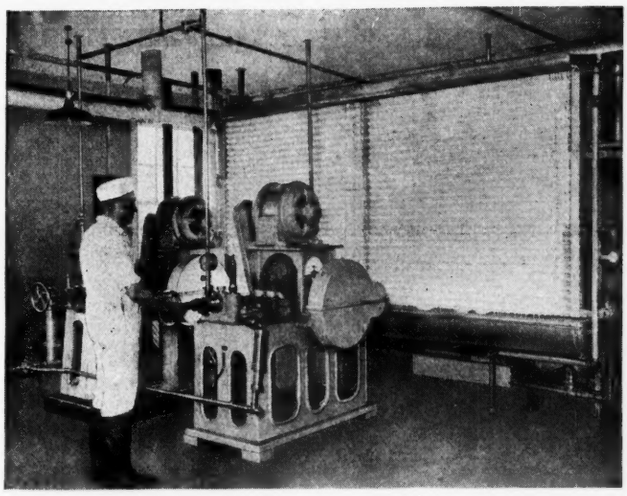
The mechanical viscosity of the mixture varies according to the pressure, the temperature and to some extent the composition of the mixture. The application of high homogenizing pressures produces a greater viscosity than a low pressure. As soon after pasteurizing as possible, and as quickly as the equipment permits, the ice cream mixture is cooled to 50 or even to 40 deg. F. The most efficient cooler is the horizontal tubular type.

A newly made or fresh mixture is "thin." Should the mixture be frozen in that condition it would not be economically receptive to the incorporation of air, and the resultant ice cream would be described as close of texture and soggy. Ripening of the ice cream mixture is necessary under practically all circumstances.

The artificial viscosity created by mechanical processes

Cleaning ice cream cans in a Rice & Adams can soaker at plant of the Plymouth Rock Ice Cream Company, North Abington, Mass.





Homogenizers and coolers at Hood's in Boston

is destroyed by the dasher of the freezer. Proper ripening of the mixture produces the biological change which causes the casein to expand and thereby prepares it for the incorporation of air and renders the desired swell or increase in volume.

Acidity is not an essential part of the ripening process and its development should be retarded lest the lactose break down as acid develops. Storage ripened mixtures when processed reach their maximum viscosity when aged from 72 to 96 hours. It is quite possible to hasten the ripening of the mixture by the addition of products that react with the milk proteins.

The freezing of ice cream is, seemingly, a definite mechanical process; yet it involves complexities, many of which are well understood and others yet to be determined through research and practice. The keynote to the manufacture of ice cream is quality and overrun. One may be sacrificed at the expense of the other; financial gain may be paramount with some manufacturers, but the modern day manager has a high regard for the quality of his product as a means of developing his business.

The quality and salability of the final product is largely dependent on the freezer operator and his knowledge of the intricacies and technical points of freezing. To make a mixture from a definite formula is a fairly easy matter, but to determine the exact composition of that mixture from the standpoint of high quality and financial returns to the business is an item requiring a very accurate knowledge of the several ingredients and how each reflects on the freezing process, overrun, quality and flavor of the ice cream.

The basic purpose of freezing an ice cream mixture is to incorporate air into the mixture by freezing to give a consistency to maintain that air. So many important factors and conditions affect the freezing process that to control them individually and collectively necessitates a rather definite knowledge of their physical and chemical relations. Briefly, these factors are as follows: kind of freezer and its power; quality and temperature of the mix; speed of the freezer; brine and ammonia temperature and pressure; volume of brine and ammonia; ingredients and their proportion; age of mixture; method of freezing and pressures applied; viscosity; and rate of emptying the freezer.

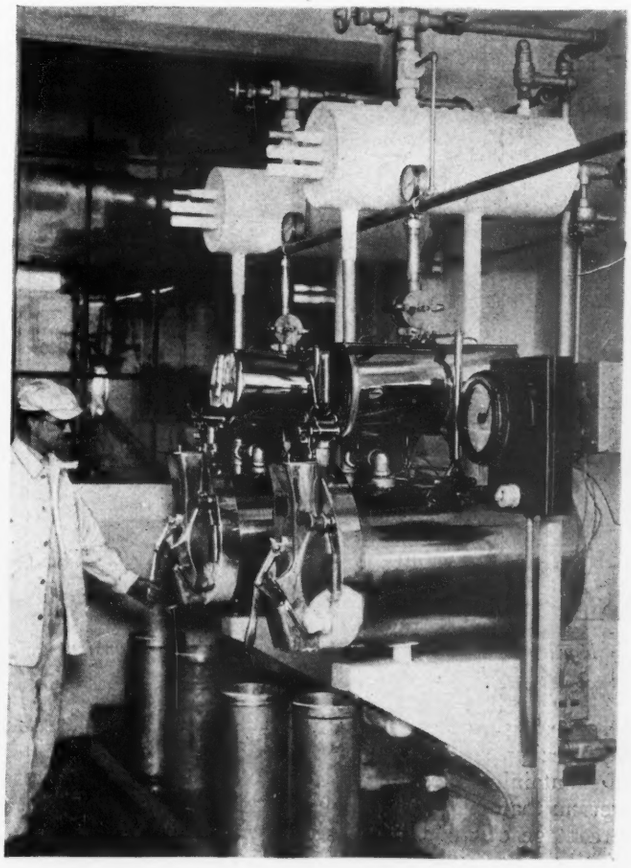
The size of the freezer makes no apparent difference in the efficiency of freezing. Each freezer regardless of its capacity should be kept in excellent mechanical condition to assure maximum efficiency of the power employed. An excess of power is a waste of money. Overloading the freezer with the mixture invites trouble —either the power is not sufficient or there is not an efficient incorporation of air. One having experienced the trouble of scrapers sticking in the freezer will appreciate the effect of overloading. The scrapers should fit snugly and should clean the surface of the freezer drum thoroughly while revolving. Bent scrapers or dented freezer walls result in the freezing of a layer of ice on the inside which acts as an insulator, thus preventing economical freezing.

Forty-quart freezers are not made for 25 quarts of mixture. Considering that a 100 per cent overrun is desired, only twenty quarts of mixture should be used in this instance. Increased volume inhibits the incorporation of air, decreases the swell or overrun, overworks the motor, and increases the cost of freezing each batch of ice cream. A temperature of 34 to 40 deg. F., when the mixture is drawn into the freezer, usually is the best average temperature with a standard mixture. This, of course, is dependent to a definite degree on the temperature of the brine and ammonia which are the freezing mediums.

The manufacturers of freezers usually regulate the speed of the dashers of their particular machine. The average is about 175 to 225 r.p.m. and this has proved to be a satisfactory speed for the proper agitation and whipping of the mixture. If the column of mixture is too great the speed of the dasher is reduced and when the brine pressure is too high, whipping is further reduced and the speed of the paddles likewise. A reduction in the temperature of the brine favors an increase in the speed of the paddles.

About ten years ago a higher brine temperature rang-

A pair of York direct expansion freezers



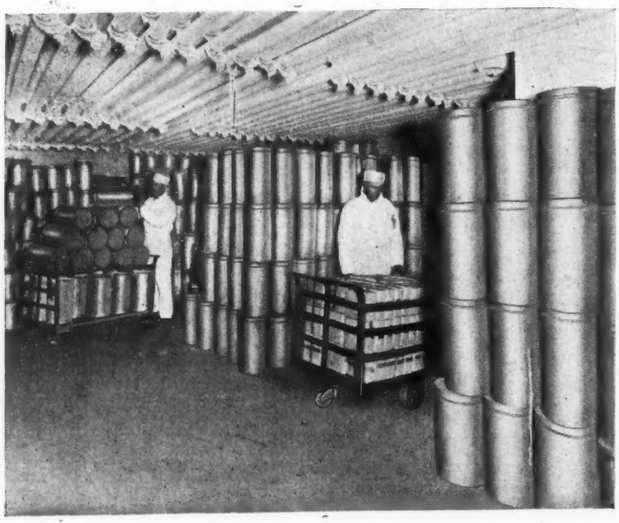
ing from 10 to 14 deg. F. was preferred. At the present time practically all ice cream plants employ a temperature of about 0 deg. F., although occasionally the brine may be depressed to —14 deg. F. With the brine temperature above 5 deg. F., more time is necessary to incorporate the air, while a low temperature results in a very rapid freezing of the mixture.

The desired pressure of the brine varies with different conditions. Ample circulation, however, is absolutely necessary. A sufficient supply of brine is one which is capable of removing the heat units from the mixture most economically.

The freezing point and its variations according to ingredients comprising the mixture is a very important consideration. By freezing point is meant the temperature of the mixture, just after the water crystals have begun to form. This factor affects the temperature of the mixture throughout the entire freezing process and is dependent on the amount of substance in solution in the water of the mixture. The freezing point of an average ice cream mixture is 26 to 28 deg. F.

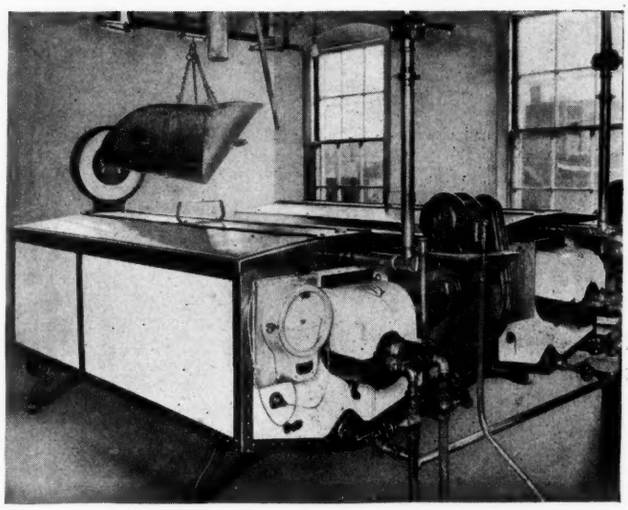
Considerable research has been pursued to determine the effect of different ingredients on the freezing conditions and quality of the ice cream, yet there is much to be learned from further investigation. A mixture with a high solids content has a low freezing point, which with a high brine temperature makes for difficult freezing. The mixture does not have the quality of stiffening readily and when drawn too soon the quality is impaired because a relatively small percentage of the total water in the mixture is frozen. Proper freezing takes up a high percentage of this water.

Authorities are agreed that an increase in the milk-solids-not-fat lowers the freezing point. This is true also of an increase in the percentage of fat. An increase in viscosity and also in the time required to freeze occurs with an increase in milk solids. As the sugar content is increased the freezing point is depressed and an increase in time is required to reach the desired overrun during



Hardening room at Hood's in Boston, where a constant temperature of zero is maintained

the freezing process. Generally, substances which lower the freezing point lengthen the time of freezing. A mixture containing a low percentage of fat will have a greater overrun than one with a high percentage of fat when the percentage of milk solids is uniform. Therefore, there must be a desirable percentage of fat which is not to any great degree detrimental to the freezing process. Butter fat increases the rate of freezing and whipping of a mixture to a considerable extent.



Mixers and pasteurizers by Creamery Package Company at Hood Ice Cream Company's Boston plant

To increase the milk-solids-not-fat and to hold the butter fat uniform results in an increased time to freeze and a reduced overrun. The quality of the ice cream, however, will be slightly improved.

Processing an ice cream mixture by means of a viscolizer or homogenizer has a very important effect on the quality of the resulting ice cream. The effect on the freezing process is important, though overrun and freezing can be fairly well controlled without processing.

The reason for processing is to reduce the size of the butter-fat globules in the mixture, thus increasing their surface area. Accompanying this is a greater absorption of the milk serum, which affects the viscosity, surface tension, quality and freezing ability of the mixture.

There are five steps in the preparation of a mixture before freezing, namely: mixing, pasteurizing, processing, cooling, and aging.

Pasteurizing destroys viscosity and aging is necessary for its recovery. The increased viscosity makes possible a greater overrun in freezing. Processing which follows pasteurizing restores this viscosity.

Homogenizing and aging cause the mixture to be individualistic in its reaction to the control of the operator, responding to different methods of whipping and freezing in direct relation to various physical properties. An unprocessed mixture with no aging is least responsive. As pressures are increased the mixture becomes more sensitive and receptive to air incorporation. Aging increases this characteristic. With the application of extreme pressures, a very high overrun is reached in a few minutes of freezing. The mixture is really too sensitive. Ice cream manufactured from mixtures processed at extremely high pressures are soggy and doughy when frozen. There must, therefore, be some intermediate pressure that is more desirable. The pressure recommended when all conditions are considered average is 3,000 lb. per square inch.

The colloidal nature of an ice cream mixture, together with the chemical changes taking place continually, makes its study a complex one. To draw ice cream from the freezer by guess or by judgment as to its proper consistency is to invite a wider variation in the quality of the product from the standpoint of body and texture. When

the time of drawing the ice cream from the freezer is prolonged the last gallon drawn will be very tough and resistant. It has a very low overrun and cannot be classed as a product of desirable quality. Such an occurrence represents a financial loss and can be said to be due to excessive whipping in the drum of the freezer as the resistance to the beaters is reduced by a removal of a part of the batch.

Since there is a tendency in some localities to promote the selling of ice cream by weight, there must necessarily follow further investigation and a closer observation of the freezing process to maintain a uniform weight, especially in the packaged product.

A mixture must have a maximum whipping point for certain freezing conditions. If this point has been reached, the last gallon of ice cream from the freezer will not weigh more than the first, and if it is not reached the product remaining in the freezer during the draw period is likely to keep on whipping while being drawn and the last gallon will weigh less than the first gallon. This will vary with the freezing method applied. A retarding of the whipping of the semi-frozen product during the draw period and a quick emptying of the freezer will effectively correct this difficulty.

Immediately after the ice cream is drawn from the freezer in a semi-frozen state it is placed in the hardening room. The purpose of the hardening room is to complete the freezing of the water in the ice cream. The temperature used in the hardening room, and hence the rate of freezing, will markedly influence the texture of ice cream. As only approximately 50 per cent of the free moisture of the original mixture is frozen during the freezing process, the remainder of the moisture must be frozen in the hardening room.

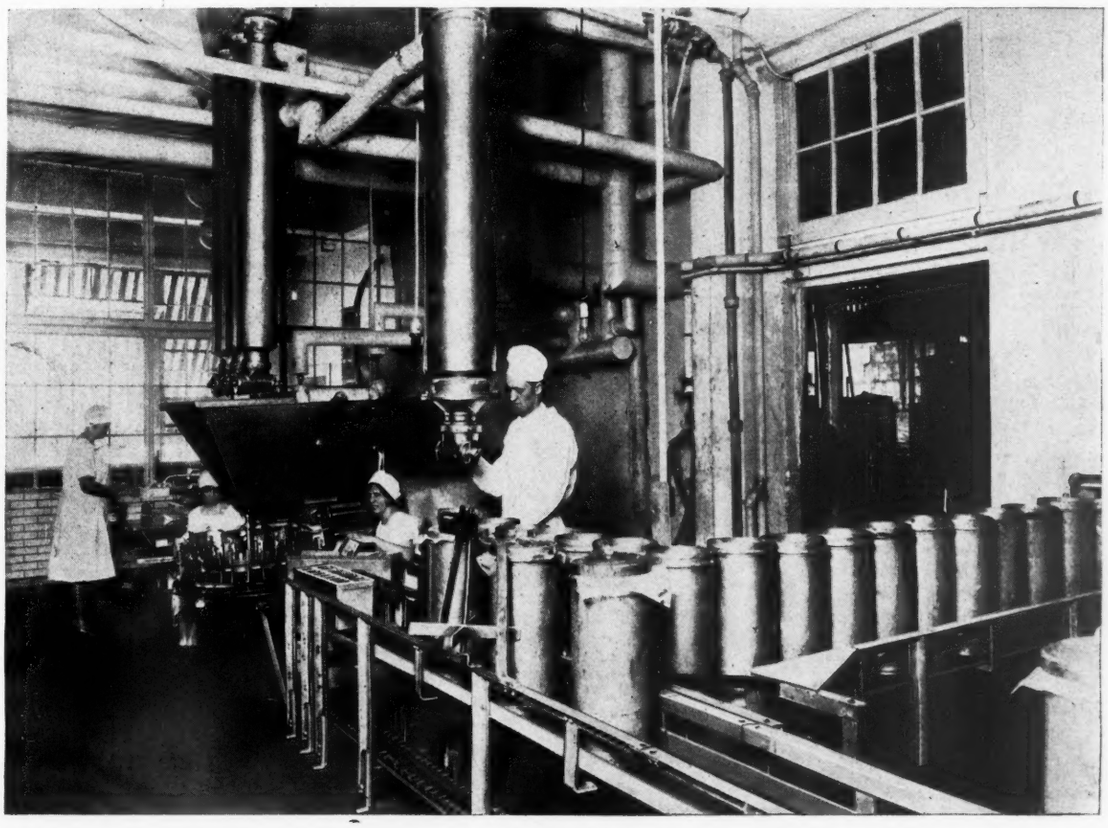
In ice cream a considerable portion of the water is tied up or fixed with the serum. This fixation of the moisture is not sufficiently stable to withstand severe heat and cold shocks such as may be experienced in a hardening room when the temperature is permitted to fluctuate over a wide range. A temperature of 0 deg. F. usually is maintained in the hardening room and there should be as little deviation from that figure as possible. A hardening room temperature of —10 deg. F. is not uncommon. A variation of temperature encourages the formation of crystals of water and sugar, resulting in a coarse ice cream. A quick freezing in the hardening room produces an ice cream with small crystal formation and is very smooth.

Investigation of problems pertinent to the ice cream industry continues to receive unlimited attention. This research is being performed in several of the agricultural experiment stations located in different states, through the efforts of research committees of the International Association of Ice Cream Manufacturers, and in many of the larger ice cream plants are to be found large modern research laboratories supervised by strictly technical men.

Research in the industry is not limited to the processing of the ice cream mixture alone. Investigational projects have been inaugurated for the purpose of studying the source and quality of the ingredients used in the preparation of the ice cream mixture; the different processes involved in plant operation; packaging and merchandising of ice creams, ices and sherbets; constructive organized advertising of these products, and the development of a uniform cost accounting system applicable in ice cream factories regardless of their capacity.

It can be said that the application of knowledge, as a result of scientific research, has raised the ice cream industry to its present high standard. Research will bring forth newer knowledge as our present and future problems are solved in a scientific manner.

Ice cream is carried from the freezers above to the packaging and can filling equipment through these downspouts; Mojonnier equipment.

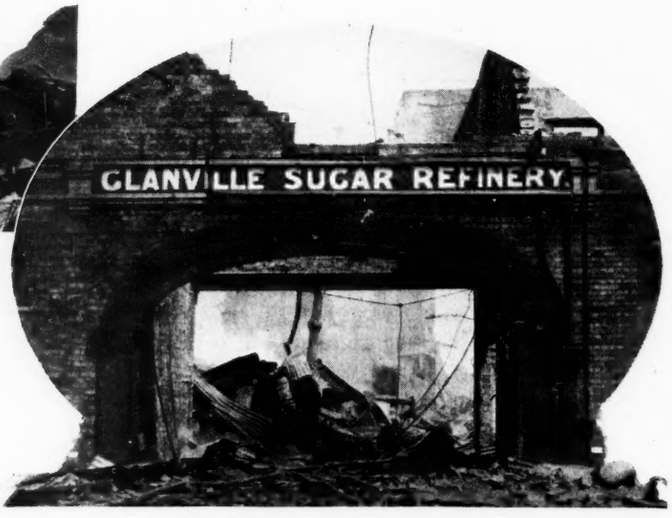


Unsolved Problems of

Five Food Plant Disasters

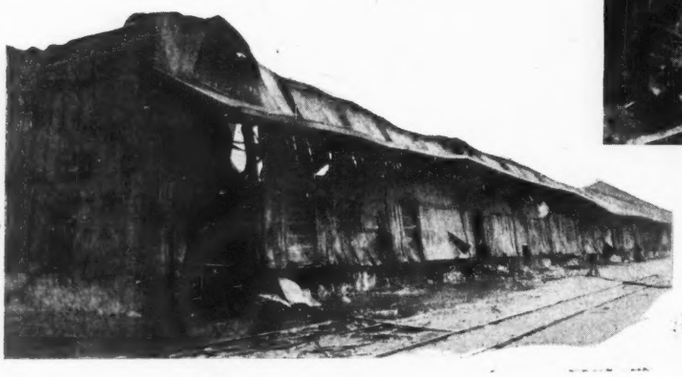
from spontaneous heating in stored dry granulated sugar

Australia contributes a sample disaster



This was formerly a profit-making sugar plant

No salvage value here



Two "complete-loss" fires from spontaneous heating in sugar

Spontaneous Heating

Fire Prevention Officials Ask Federal Co-operation—Proposals Referred to Chemical Engineering Division, Bureau of Chemistry and Soils

DOES STORAGE of granulated sugar involve the fire hazard of spontaneous combustion? This is one of the serious questions on spontaneous heating and fire hazards which has been presented recently. Moreover, it is one of the questions of most general interest to the food industries of the United States, which will follow with close attention the proposed conference and investigations on these subjects.

Is the lowly burlap bag a safe container? This is another question of still more general interest, for burlap and jute bagging are under suspicion among the fire-prevention authorities of the country. These gentlemen will be joined by all industrial executives who would like to know whether jute is an industrial culprit occasionally guilty of arson.

Possibly there is no need for great alarm regarding these and the related questions on spontaneous heating of industrial materials in storage; however, there is need for application of the best knowledge at present available. There is even more need for increased information regarding the general phenomenon of spontaneous heating. The importance of this will be evident from a brief consideration of that universal industrial commodity, sugar.

During the past dozen years there have been at least fifteen or twenty instances in which industrial fires have occurred in stored sugar where spontaneous heating seems to have been the only explanation of the cause. There probably have been a hundred other fires in sugar warehouses or sugar refineries caused by discarded matches, cigarette butts and the like, defective wiring, careless industrial practices, and other well recognized hazards. In the smaller group of instances referred to, however, it seems difficult to account for the fires by any one of these commonly recognized hazards. Especially is it difficult to see how any of them can account for fires which have started in the centers of piles of stored sugar in the middle of the night in warehouses which have been regularly inspected but in which warehousing operations have not been carried out during the preceding several days. Such fires seem to "just happen"; and spontaneous combustion appears to be a probable cause.

The authorities who have investigated this matter cannot see how dry refined sugar can in itself be spontaneously combustible. Yet storage of this material in clean new burlap bags lined with cotton cheesecloth has resulted in several of the mysterious fires which in the aggregate have caused millions of dollars of fire loss to plant and stored refined sugar. Some weird theories have been developed to account for this situation, but certainly among these theories there must be some truth. It is well established, for example, that a pile of damp jute bagging will heat; in fact, at least one serious marine fire was caused by spontaneous combustion in a hold filled with wet bagging. It also seems likely that moist raw sugars can heat, probably due to bacterial action in the mass. But dry refined sugar in dry clean bags is another thing. What of it?

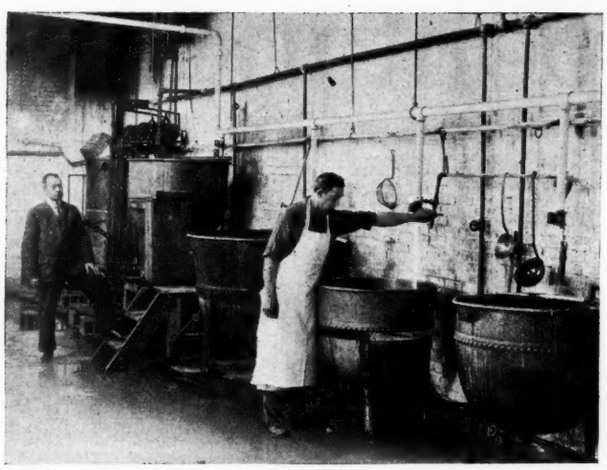
Some observers have blamed the stamping or lettering on the bags. They point out that the inks used very often include quick-drying oils which are well recognized as hazardous combinations on fabrics. Witness the common household fire caused by oily or waxy cleaning rags! These observers also point out that oil often is used to soften the fiber of sisal or jute and that this may create a possible source of heating when pressure, moisture, bacterial action, or any of them combined or alone creates the otherwise favorable setting for generation of heat without a chance to dissipate the energy to the surrounding air.

At the recent annual meeting of the National Fire Protection Association in Memphis, Tenn., this problem received considerable attention, with the result that this association formally requested the U. S. Department of Agriculture to join with it in calling a conference on the general subject of spontaneous heating as a cause of fire. This matter has been referred by the department to the Chemical Engineering Division of the Bureau of Chemistry and Soils, which has been for several years engaged in the study of agricultural and industrial hazards, including dust explosions and fires. David J. Price, chief of this division, while recognizing the great importance of the proposed investigations, warns against any alarmist interpretations. He points out that the cases where spontaneous heating is blamed for industrial hazard in food plants are very serious, even though few in number compared with the cases in which such materials are handled with complete safety. The need for that additional information which can come only from a thorough and comprehensive technical investigation is already widely recognized.

It is anticipated that both agricultural and industrial materials will be considered in the proposed conference, which is likely to be held during the early fall in Washington, D. C. The government officials and the officers of the N.F.P.A. cannot know of all interested groups. They therefore ask that any companies or individuals desiring to participate in this conference communicate at an early date with the Chemical Engineering Division, Bureau of Chemistry and Soils, Washington, D. C. Those who have information or experience pertinent to this work are invited to make it known to this same office. All interested will then be notified in due time of the date and plans for the conference, so that they may participate.

It is to be hoped that the proposed conference will develop some basis on which a thorough technical study of industrial spontaneous heating may be carried out. No group of industries is more interested in this than the food industries, for they handle and process many agricultural raw materials which are known to be subject to spontaneous heating and they also manufacture many products which may involve such hazards if not properly handled and stored.

Processing ITALIAN CHERRIES *in America*



Adding refined sirup to the cherries at the Corona plant

By S. BLUMENTHAL and L. THUOR
Shirley Laboratories, New York City

THE MANUFACTURE of Maraschino-type cherries has grown by leaps and bounds during the past 30 years, and today it holds a moderately important position in the food industries, judged by the value of its finished products. That an industry, can grow when properly nurtured is aptly shown by the Maraschino cherry business. Only in rare instances, however, are the Maraschino cherries made in this country flavored with the genuine distilled flavor made from Marasco cherries grown in Dalmatia. The words Maraschino-type, therefore, designates the imitation of the French product, which is approved by the United States government. Almost three decades ago a few barrels of cherries in brine were imported by American companies to manufacture a Maraschino type of cherry. During the year 1928 the industry has grown so that close to 45,000 barrels of cherries in brine were imported from Italy and around 7,000 barrels imported from other countries. The aggregate value of this raw material was almost $2,000,000 and today the demand of the American consumers exceeds the supply.

New plantings of cherry trees are made in Italy at the rate of about 10 per cent a year, while the actual production of this fruit increases at about 7 to 8 per cent a year. In the past ten years a marked increase in Italian plantings and fruit output has taken place. It must be borne in mind that this increase represents only a possible increment in the amount of cherries exported, inasmuch as exports are extremely elastic, depending upon the demand from abroad.

A conservative estimate of Italian cherry production would be approximately 110,000,000 pounds annually, of which about 50 per cent would represent a possible export of cherries in brine. During the years 1924, 1925 and 1926 the exports of fresh cherries from Italy were, in round figures, 25,000,000, 36,000,000 and 47,000,000 lb., respectively, giving an average annual export for these years of 36,000,000 lb. Of the 47,000,000 lb. exported in 1926, roughly 30,000,000 lb. represent cherries in brine, of which the United States took about 15,000,000 lb. as compared with 12,000,000 lb. in 1925. From 60 to 70 per cent of the cherry exports of Italy, according to reports, can be considered cherries in brine.

As a result of heavy export demand of cherries in 1926, especially from the United States, speculators invaded the growing districts and contracted to buy the cherries of the 1927-1928 crop. High prices were offered on the assumption that the demand from abroad would continue. This proved unfounded, for the foreign market had been heavily supplied, and prices declined 50 per cent, and finally 75 per cent. The speculators, of course, took a tremendous loss, by forfeiting the deposits made to bind their contracts.

The desirable characteristics of cherries to be packed in brine are: average development; sweet, firm, white pulp; skin, light red in color. Unlike the Royal Anne variety of cherry, which is chiefly used in the United States for sulphuring, brining, and subsequent manufacturing into Maraschino and glacé cherries, the Italian producers utilize several varieties, of which the Graffioni. Duroni, Napoleone, Imperiale di Napoli, and the Regina del Mercato are the best known. These are all light colored, and experience has shown that they are the most satisfactory cherries for processing. Black and deep red cherries are not suitable and consequently are not thus utilized. Cherry growing is said to be increasing, notably in Bisciqlie in the Province of Bari. The greater part of this, however, is early fresh fruit. The export industry is said to be developing in the application of better packing and selecting methods. Six sizes of cherries have been chosen in the packing plants of Apulia, and sieves are constructed for the proper selection of the different sizes. The harvesting season

References—Consular Reports, Department of Commerce; Refined Syrups, Inc., New York City; Fruit Products Corporation, Bellville, N. J.; Corona Fruit Preserving Co., Inc., Brooklyn; Cherrico, Inc., Arlington, N. J.

for picking cherries in Italy begins about May 15 and ends about July 15.

During the past two years the pitting of cherries in Italy for export trade has been started. It is done entirely by hand and has proved profitable because of the higher prices obtainable for pitted fruit. However, manually performed cherry pitting was at first discouraged, due to the slowness and tediousness of the work, but the better quality of fruit which resulted from hand pitting has kept the method in force. The hand-pitting of cherries is carried out on a very large scale today and no doubt will continue this way.

Although the Italian cherry crop of 1928 is reported to have been smaller than normal, the quality is said to have been excellent, and prices were double those of 1927. The total quantity of sulphured and brined cherries produced in 1928 was somewhat larger than in 1927, being approximately about 48,500 barrels (100 kilos or 220 lb. to a bbl.). Of this quantity 37,000 barrels were prepared by the sulphuring and brining industry to meet the requirements of Italian foreign markets. The largest consumer of sulphured and brined cherries is the United States, which takes approximately 90 per cent of the total Italian export. The remaining percentage goes chiefly to France and England, while a few barrels are occasionally exported to Germany, Belgium, and Mexico. In 1928, owing to a shortage in the French cherry crop (the crop may have been roughly one-third less than in 1927), France has been obliged to import from Italy a larger quantity of brined cherries than usual.

The methods of sulphuring, brining, steaming and pitting cherries do not differ essentially in Italy from those employed in the United States. The object of sulphuring is to arrest decay temporarily, to bleach the cherries to a uniform pale amber color, and at the same time to give firmness to the tissues. The fresh fruit, which is placed in half-filled baskets (about 10 kilos to each basket), is exposed to the fumes of burning sulphur in a closed room for about 12 hours. For a room well filled with baskets of fruit the proportion of sulphur employed is about 1 kilo to 100 kilos of fresh cherries. This sulphuring process customarily takes place at no great distance from the place where the cherries have been gathered since necessarily, it must be done expeditiously.

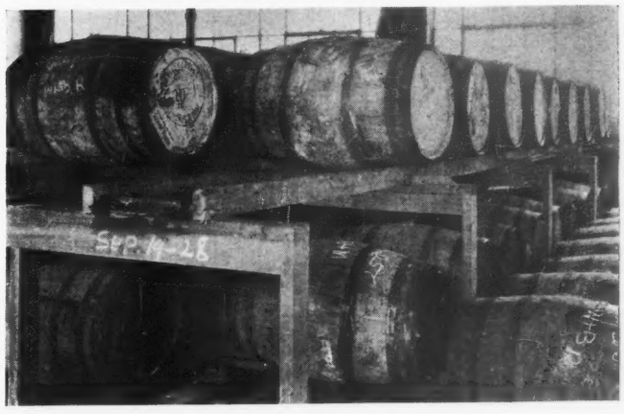
When sulphur burns in the air it burns to sulphur dioxide. But since this sulphur dioxide is very soluble in water, it dissolves in water to form the acid known as sulphurous acid Sulphur dioxide of itself, that is the dry gas, is inert with regard to the ability to preserve fruit. It is only when in solution with water that its properties become valuable. The grower, therefore, sprinkles a little water on the fruit so that sulphurous acid is formed which preserves the fruit. Since the temperature is a function of the activity of the acid it follows that at higher temperatures quicker results are obtained. The sulphur man accordingly takes advantage of this and uses an elevated temperature when advisable. Since sulphurous acid can be removed by washing, this method is a cheap and relatively inoccuous method of preserving fruit.

Subsequently the cherries are packed in casks having a capacity of 200 liters of water and covered with several liters of water containing disolved sulphur dioxide, which not only preserves them for a period of two to three years without decomposition but also protects them from injury in transportation. The usual quantity of cherries packed in a barrel is 100 kilos (220 lb.). About 70 liters of water is used to which is added 3.5 to 4 liters of a 3 per cent solution of sulphur dioxide. A little salt is added to the contents of each barrel intended for export to the United States, not, it is stated, because the latter enhances the preserving quality of the liquid with which the cherries are covered but to meet the requirements of the declaration "in brine."

The steaming and pitting of cherries is all done by hand, by women and girls, after the cherries have been treated to both sulphuring and brining and generally at a period some months later in the year whenever the circumstances warrant it. A special kind of pitting implement—a sort of tiny steel spoon with sharp edges, said to have been introduced from the United States—is now employed by pitters in all Italian cherry-preserving factories. Great care must be exercised not to break the fruit in the process of removing the pits. Notwithstanding the skill of the operators, it is estimated that from 10 to 20 per cent of the cherries are damaged while being pitted and must, of necessity, be sold as "broken" or imperfect fruit.

It is estimated that 150 kilos of fresh fruit will yield about 100 kilos of stemmed and pitted cherries. The quantity of cherries which an experienced pitter can handle in one day depends, of course, upon the size of the fruit. The average for the smaller cherries is 10 to 15 kilos, and for the larger cherries 30 to 40 kilos per day.

Cherries in brine formerly were exported into the United States without being first stemmed and pitted, but this is no longer done. Most, if not all, cherries are now stemmed and pitted by the Italian producers



Italian cherries in brine just as they are received from Italy, in storage at Cherrico's

before they are shipped from the factories. It is estimated that of every hundred kilos of sulphured, brined, and pitted cherries produced, only about 65 per cent can be marketed as "whole" while the remainder must be sold as spotted or broken fruit.

The cherries in brine imported from Italy are bought on the basis of 100 to 105 kilos per barrel. When these cherries arrive in the United States a certain amount of shrinkage has taken place which may run as high as 10 per cent. The quality and size of the cherries are taken into consideration by the American buyers and the following important factors should also be taken into account before they make their selections. The cherries should be of the free-stone variety; graded fairly evenly; they should be meaty and not of the very small type with large pit centers, and the shape should be round without

Cherry-pitting spoon, about ½ actual size

blemishes or spots. Since the cherries are bought by size they are graded according to four standard sizes:

(1) Dipping Ranging from 10-14 Millimeters in diameter
(2) Small Ranging from 14-18 Millimeters in diameter
(3) Medium Ranging from 18-22 Millimeters in diameter
(4) Large Ranging from 22-26 Millimeters in diameter

When these cherries in brine arrive in this country they are weighed by licensed weighmasters under the supervision of custom house inspectors. An average of the whole shipment—that is about 10 per cent—is weighed and from it the weight of the entire shipment is then estimated.

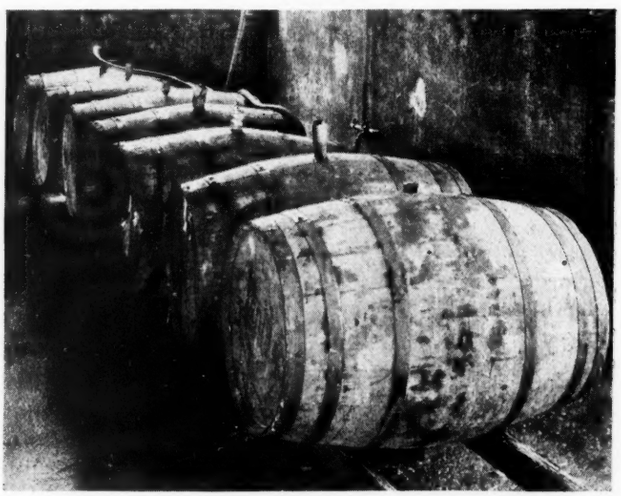
When the cherries are received at the Maraschino packing and processing plants they are then run through a sorting machine which grades the fruits for size. They are then washed free from brine and sulphur dioxide or sulphurous acid. Some use large vats, through which a counter-current of water is running, some use barrels, while some weigh the cherries into clean paraffined barrels and process them directly in these barrels with cold sirup. Others use plain barrels with hot sirup. The procedure at this point varies with the plant and is a very closely guarded manufacturing secret.

However, about 300 lb. of fruit is weighed into a new barrel which is covered with fresh water that is changed at regular, predetermined intervals. In one plant a man is able to fill systematically, allow to stand and empty 80 to 100 barrels per working day. Many repeated washings remove the sulphur salts, which is, in reality, a long-drawn-out process. Every plant has its own methods, some of which are very efficient. However, the essence of every method is the use of plenty of water. For those states that permit sulphur dioxide in cherries, the treatment is not so arduous as for those states that have ruled against it.

Many washings of the cherries during a period of several days will reduce the sulphur dioxide to the point where it will be under the legal limits. Naturally, this treatment has a tendency to break some of the skins and make the product slightly lacking in uniformity. However, for shipments to those states that do not tolerate the presence of sulphur dioxide there is available at present a chemical treatment which is very effective and simple in operation. It shortens the process to about eight hours and no trained help is required. The method in general is to dissolve a weighed quantity of the preparation in warm water and add it to a barrel of cherries which has been previously filled with warm water. The barrel is now rolled a few times to mix the preparation and the water, afterward allowing the barrel to remain at rest with the bung partly open. At the end of the six to eight hours the sulphur dioxide content has been reduced to about 25 parts per million. The cherries in the barrel are then washed once or twice with fresh water and the fruit is ready to be put through the coloring process.

The water used in removing the sulphur dioxide from the cherries can be either hot, luke warm or cold. As the percentage of sulphur dioxide is reduced by washing, the cherries attain a grayish cast. This, of course, must be expected when the bleach is partly removed. However, if the fruit was not of a uniform light red color before it was bleached the cherries will assume a darker cast. Some cherries have a grayish cast even in brine, and this may be due to absorption of tannic acid from the barrel. Although the barrels are coated with paraffin, often it will separate from the staves and permit the cherries to come in contact with the wood, where they may absorb some of the tannin. Since there always is a small quantity of iron present either in the water or in the fruit, iron tannate will always form under these conditions. Iron tannate is a dark salt and discolors the fruit. Where a considerable quantity of cherries is darkened in this manner either before or after the removal of sulphur dioxide, the judicious use of acids will lighten the color to a considerable extent.

Ponceau 3 R is a certified pure food color which usually is employed to color the cherries red, Ponceau S X,



Filling barrels of cherries with water to leach out the sulphurous acid

a new color recently added to the list of certified pure food colors, is of the same shade of red as Ponceau 3 R, and is being experimented with at the present time for its possible use in coloring Maraschino cherries.

After the sulphur dioxide has been reduced to the point where it complies with the pure food laws, from 1.5 to 2 oz. of color is dissolved in a bucket of warm water. This solution is then added to the barrel of cherries.

At this point a small quantity of sulphur dioxide solution may be added to the cherries, even though practically all of it has just been removed by the washing process. This curious re-addition of the SO_2 is for the purpose of obtaining a very bright red color but it is permissible only where the Maraschino cherries are to be shipped to states that will permit a definite amount of sulphurous acid in foods.

The barrel is rolled daily to insure uniform color. At the end of a week of repeated rollings the cherries have taken up all the color that they can absorb. Of course where the manufacturer does not care for the appearance of his goods or where time is a factor, he can warm his color together with the cherries in a copper or a glass lined kettle. All color solution should be saved and made up to standard strength in order to cut down the cost of the color used. Under no

circumstances should this valuable ingredient be allowed to run down the sewer.

While originally there was only one Maraschino type of cherry this, of course, is no longer true, as the real Marasco cherries are not always used. But when other cherries are given this treatment we speak of them as being of the Maraschino type. Of course, there are cherries on the market flavored with mint and colored with Light Green, S. F. Yellow or Guinea Green B. In the same fashion other flavors and colors can be produced.

The cherries are now ready for the sugar sirup. At this point many ways of introducing the sirup may be used. Where a cold process of sugar curing is used, by adding a 36-deg. Baumé sirup to the barrel and rolling around a few times and then allowing the barrel to stand for about seven days in a cool place, the Baumé reading will then be reduced to about 20 deg. This sirup is then drawn off and reinforced to its original strength by the addition of sugar. This in turn is allowed to stand until the Baumé is reduced to about 22 deg.

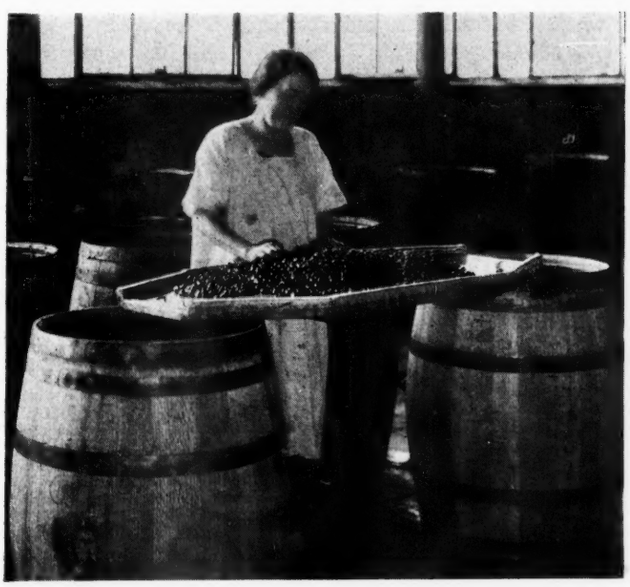
Some packers of the Maraschino cherries are buying their 36-deg. Baumé sirup already prepared for them by refiners of raw cane sugars. This sirup has the same quality and gives the same results and is cheaper in price than granulated sugar.

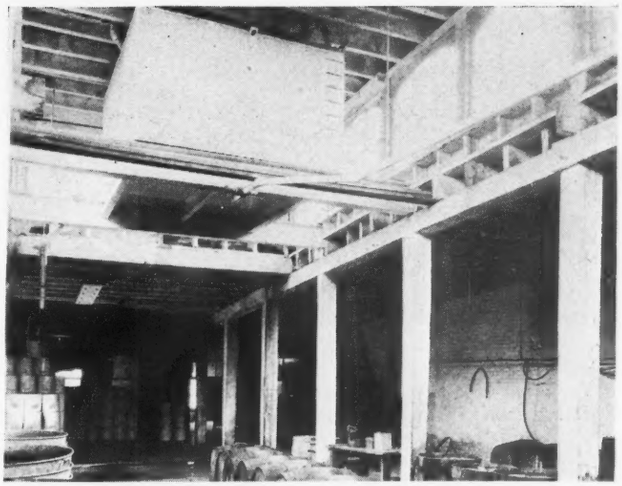
The sirup is stored in a reservoir located at a convenient point in the factory from which the entire plant is fed by gravity through a 2½- or 3-in. pipe line. This enables the manufacturer to charge his curing barrels or kettles with 36-deg. Baumé sirup by the mere twist of the valve.

Another method of introducing the sirup is by the addition of hot sirup to the cherries and, as the Baumé test of the sirup on the cherries falls, to reinforce with hot sugar sirups having a stronger Baumé test. Finished barreled goods usually register around 22 deg. Baumé, while bottled goods test around 14 deg. Baumé. When we note that bottled goods are further pasteurized while barreled goods are not we know the reason for the difference.

The pure food and drug act allows, as a preservative to be added to the cherries, the use of 0.1 per cent of sodium benzoate. The weight required per barrel is dissolved in a small quantity of warm water and added to the cherries. Sodium benzoate, a synthetic product, should always be bought on the quality basis and not price. Inferior qualities of sodium benzoate may sometimes impart a peculiar odor and taste to the cherries. This is especially true when a hot process of preserving the cherries is used as the impurities of sodium benzoate are somewhat volatile with heat and may impart a decided phenolic taste to the cherries.

Sorting out any broken cherries on a drain board at Cherrico's plant.



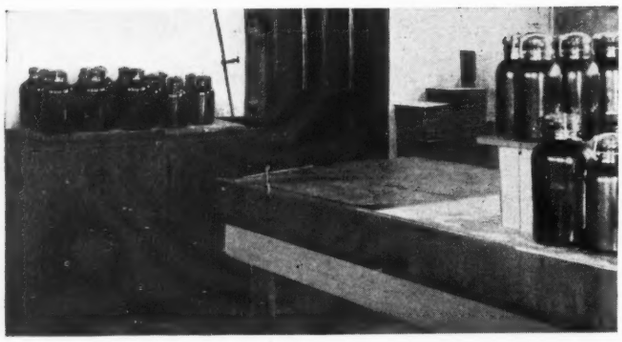


Sirup storage tank above the work room at Corona's plant. The 5-gallon crocks in the background are used for making glacé fruit

True Maraschino cherries are flavored with a liqueur known as Maraschino liqueur, a colorless liquid which has a delicate flavor resembling bitter almonds. It is produced from that species of wild cherry, almost black in color, called "Marasca," which is especially abundant in Dalmatia. The fruit is gathered before it is quite ripe and after the removal of the pit the pulp is pressed. The resulting juice is then allowed to ferment; a certain quantity of Marasca leaves are then added and frequently about 10 per cent of grape wine. The whole is then distilled and the distillate—Acquavita di Marasca—is sweetened with sugar sirup. After filtering, this is the product known as Maraschino flavor. Not all of the Maraschino flavor of commerce today is made of Marasca cherries. In fact the flavor so-called Maraschino is nothing more than an alcoholic extract of oil of bitter almonds. This flavor dissolved in alcohol, is added to the cherries in barrels in the proportion of 1 to 3 ounces of oil per barrel.

Bulk cherries are sold in ten different sizes, according to count—this term meaning the number of cherries that will fill a gallon measure—as follows: 500-600, 600-700, 700-800, 800-900, 900-1,000, 1,000-1,100, 1,100-1,200, 1,200-1,300, 1,300-1,400, and 1,400-1,500. The smaller sizes are used for dipping purposes. The larger sizes are used for decorations and salads. Maraschino cherries are put up in several sizes of glass jars. The sizes of the packages follow: 3-oz. jars packed with 800-900 count cherries; 5-oz. jars, with 900; 8-oz. jars, with 700-800; 16-28-oz. jars, 600-700 and ½- to 1-gallon jars with 700-800 count.

Bottled goods are covered with a 14-deg. Baumé finishing sirup without added color. No benzoate of soda is used in this sirup because all bottled goods are pasteurized, and each size of bottle receives a definite treatment in the pasteurizer. Since it is evident



A large tank of water at the proper temperature, such as is shown in the background, is the simplest form of pasteurizing equipment. The gallon and half-gallon jars have just been pasteurized at the plant of Cherrico, Inc.

that larger bottles require a longer period of time for pasteurization care must be taken to see that the prolonged treatment does not soften or smash the cherries. The average pasteurizing time for the various sizes of jars has been experimentally determined, as follows: 2 and 5 oz. jars are held for 40 minutes at 175 deg. F.; 8 oz. jars, for 50 minutes at 178 deg., and 16 oz. jars for 55 minutes at 180 deg. These temperatures mean that at the very center of the jar the product will attain the pasteurizing temperature. It does not mean that the temperature on the retort is the sterilizing temperature of the cherries in the bottles.

The bottles are now allowed to cool, before labeling, by spreading out the trays which contain them. Continuous cooling by the graduated use of water of graded temperatures has not yet been put to any extensive use.

The bottles are packed with 2 or 3 dozen in a case. Half-gallon jars are packed six to a case. One-gallon jugs are packed four to a case. The Bureau of Food, Drug and Insecticide Administration allows the use of sodium benzoate up to 0.1 per cent and sulphur dioxide is permitted in concentration up to 350 parts per million or 0.035 per cent. On the other hand, Pennsylvania prohibits the use of sulphur dioxide. New Hampshire does likewise.

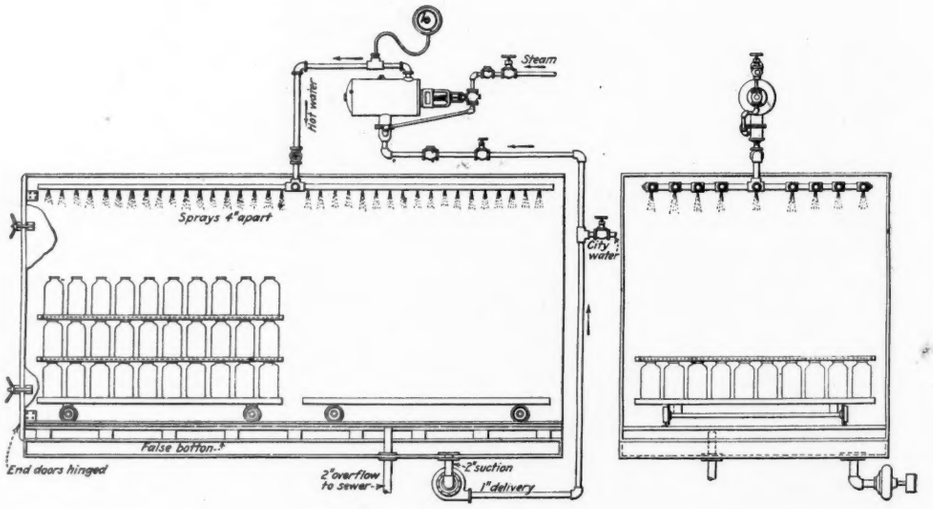
Maraschino cherries are sold to the trade as whole, whole and broken, minced, and crushed and in all various counts up to 1,400 per gallon. Maraschino cherries are sold in bottles to the confectionery stores, groceries, delicatessen stores. Only the bottlers, candy manufacturers and food manufacturers buy cherries in glass. The cherries purchased in this manner are used to a large extent for garnishing foods, soft drinks and the like. Retail consumers may eat them whole, or when covered with chocolate as in cherry cordials.

Glacé cherries are made by first thoroughly washing out the sulphur dioxide from the cherries in brine, may require from four to seven days, depending upon the firmness of the fruit. The cherries are then subjected to parboiling for about 20 minutes and then cooled quickly in running cold water. Twenty-gallon wooden tubs, or barrels which are cut in half, are filled with the cherries which are then covered with a light sirup to which color has been added. The tubs and sirup are allowed to stand overnight and are then transferred to a copper kettle. The cherries are then brought up to a boil and held for about three minutes. They are then transferred to 5-gallon crocks or enameled pails, allowed to stand overnight, then are returned to the kettle, and the sirup reinforced with more sugar. This procedure is repeated until the cherries are impregnated with the desired amount of cane sugar and corn sirup.

Some firms adhere to the practice of adding only hot sirup to the cold cherries. The cherries are drained each time and the sirup is heated with the addition of more sugar. This method is slow but it results in a better tasting product of a more desirable color. When the cherries have been thoroughly sugar-cured they appear almost transparent to light. They are then transferred to a very large kettle in their own sugar sirup and brought to a boil. They are held here for about 20 minutes and then spread over draining boards and allowed to drain and dry for 24 to 36 hours. The cherries must not be too sticky to the touch and when properly made should not become sugary over a period of three to four months.

Glacé cherries are used extensively in fruit cakes, stuffed fruits, and fruit marmalades and candies.

Other products that are made from cherries in brine are drained cherry pieces. This merchandise usually is selected as broken, ununiform fruit and is made rapidly with color and sirup in a one-cook process in the kettle. The fruit is then allowed to drain and dry. It finds extensive sale among bakers, ice cream makers and manufacturers of cherry-flavors.. Glacé cherries are used extensively in fruit cakes, stuffed fruits, marmalades and candies.



A method of pasteurization employed in some plants places the jars on a truck, separating the layers with a coarse screen wire in a wooden frame. The layers of jars may be staggered if desired. Water of the desired temperature is sprayed over the jars, then recirculated while restoring the heat lost by passing it through a Fulton hot water mixer which automatically maintains the predetermined temperature. A tank of water above the pasteurizer equipped with steam pipes, water pipes and a thermometer can be used instead of the automatic mixer, but the time of one man is required for its operation without insuring accurate temperature control.

How Fruit Products Corrode Metals

By E. MRAK and W. V. CRUESS
Fruit Products Laboratory,
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THE corrosion of metal equipment and containers used in the preparation and preservation of fruit products is a source of serious loss to these industries. The effect of the dissolved metal on the quality of the products is of far greater importance than the damage that may be done to the metal by the product. The color and flavor of the product may be so badly injured as to greatly lower its value or render it unsalable in extreme cases. In general, because of their higher acidity, fruit products ordinarily exert a greater corroding action on metals than do the non-acid food products.

While the literature on the corrosion of metals used in the building industries is voluminous and varied, relatively little of a systematic nature has been published on the corrosion of metals by fruit products.[1] In work reported in 1923 Donauer[2] made observations on the rates of corrosion of various metals by milk. He classified the metals studied in order of their resistance to corrosion as follows (Ag, most resistant; Zn, least resistant): silver, German silver, brass, bronze, Monel metal, copper, nickel, steel alloy II, white metal alloy, tin, nickel-iron alloy, aluminum bronze, steel alloy I, aluminum, steel alloy III, iron, and zinc. He found that minute quantities of some metals gave a "metallic taste" to the milk—e.g., Cu, 1 part in 240,000, and Sn, 1 part in 25,000.

Donauer[3] also compared the rates of corrosion of a number of important metals in various fruit and vegetable products and reported that the color of tomato products was markedly injured by prolonged contact with copper, tin, nickel, and iron. In solutions of the pure acids most metals corroded more rapidly in citric acid than in tartaric and more rapidly in tartaric than in malic. Sanford[4] found that the following metals varied in their resistance to dilute solutions of acetic acid in the following order (most resistant first): Silver plated copper, aluminum, Monel metal, copper, nickel, and tin-plated copper.

Culpepper and Caldwell[5] have found that the anthocyanin pigments of fruits decidedly affect the rate of corrosion of tin containers by canned fruits. Corrosion was found to be more rapid in low acidity than in high acidity in the presence of anthocyanin. Donauer found that fruit juices of high color exerted a greater corrosive effect on the metal of kettles than did those of low color, even when the latter possessed greater acidity.

Plan of Investigations—In our investigations rectangular sheets of copper (hard, soft and medium), nickel, iron, tin, Monel metal, bronze, Ascoloy and Enduro were cut to as nearly the same dimensions as possible and the exact length, width and thickness of each piece was determined by micrometer calipers. A small hole was drilled in each piece so that it might be suspended in the corroding solution by means of a thread. All pieces were burnished, cleaned with ether and distilled water and dried in an oven at 100 deg. C. after wiping as dry as possible with a clean cloth.

In most of the experiments the metals were suspended in 900 c.c. portions of the corroding solution in a 1,000 c.c. florence flask equipped with a reflux condenser. In most tests the liquid was maintained in an actively boiling condition in order to obtain maximum corrosive action and to maintain a fairly constant temperature. Eight flasks were used in each run; at intervals duplicate strips of metal were removed, washed, dried and weighed; these strips removed for weighing were not returned to the flasks during the run, as it was deemed best not to interrupt the action.

It was found that rubber stoppers gave off sulphur or hydrogen sulphide that reacted with the metals and caused increase rather than decrease in weight; plain cork stoppers were not sufficiently vapor-proof and tinfoil covering for corks or stoppers was not permissible because traces of dissolved tin might interfere with the corrosion of the metal under observation. Boiling the rubber stoppers in rather strong sodium hydroxide solution for several hours removed the sulphur and made the rubber suitable for use in the tests.

In one series of experiments a large water bath with automatically controlled gas heater was used as the heating vessel and the containers of solution and metal strips were immersed in the water for definite periods.

Comparative Corrosive Action of Various Acids Occurring in Fruit Products—Solutions of U.S.P. citric, tartaric and malic acids and C.P. acetic acid were prepared in distilled water and diluted to 0.15 normal —i.e., approximately 0.9 per cent for acetic, 0.97 per cent

[1]Those desiring to read a comprehensive and authoritative treatise on the general subject of corrosion and corrosion of structural materials in particular should obtain "Corrosion Causes and Prevention," by F. N. Speller; McGraw-Hill Book Company, Inc., 1926.

[2]Donauer, M., "The Action of Metals on Milk." Reprint from *The Ice Cream Review*, 1923.

[3]Donauer, M., "Action of Metals on Fruit and Vegetable Products, *Chemical Age*, September, 1923.

[4]Sanford, E. A., "The Corrosive Action of Acetic Acid on Common Metals," *The Glass Lining*, 1928, No. 4, pp. 12-13.

[5]Culpepper, C. W., and Caldwell, J. S., "The Behavior of the Anthocyan Pigments in Canning," *Jour. Agr. Res.*, 35, pp. 107-130.

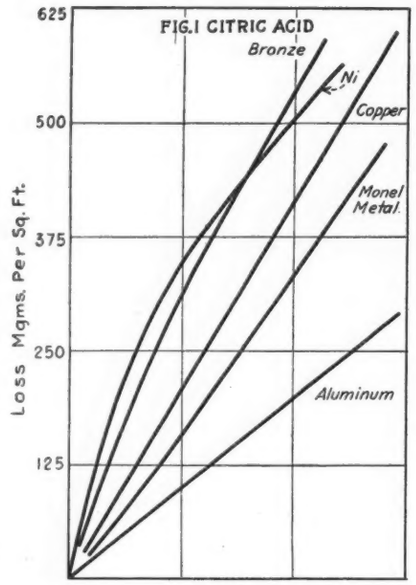


FIG.1 CITRIC ACID
Bronze
Ni
Copper
Monel Metal
Aluminum
Loss Mgms. Per Sq. Ft.
625
500
375
250
125

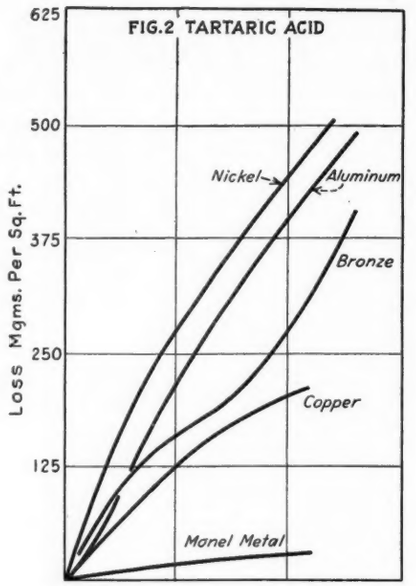


FIG.2 TARTARIC ACID
Nickel
Aluminum
Bronze
Copper
Monel Metal
Loss Mgms. Per Sq. Ft.
625
500
375
250
125

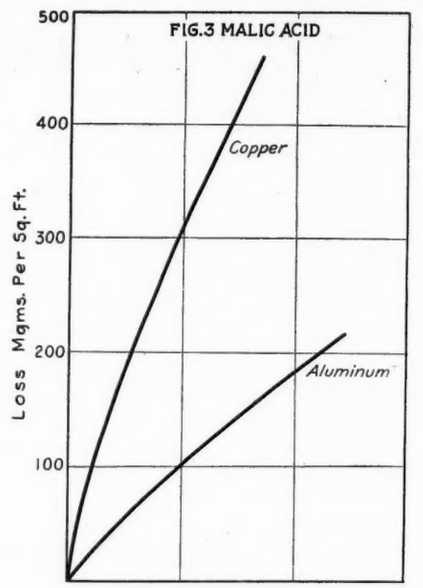


FIG.3 MALIC ACID
Copper
Aluminum
Loss Mgms. Per Sq. Ft.
500
400
300
200
100

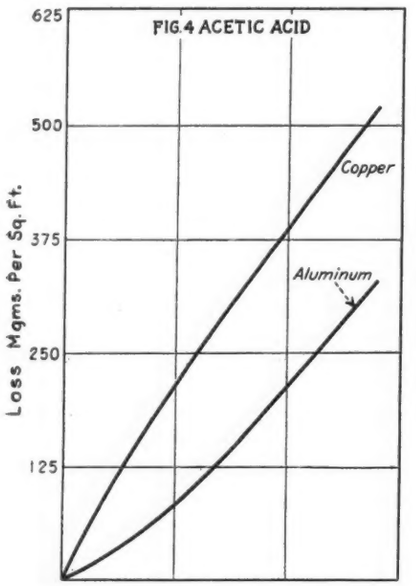


FIG.4 ACETIC ACID
Copper
Aluminum
Loss Mgms. Per Sq. Ft.
625
500
375
250
125

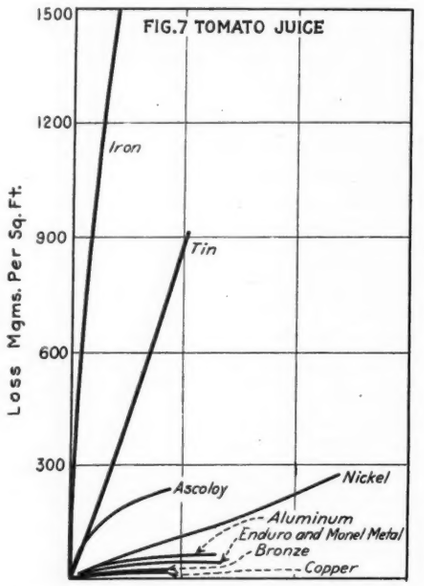


FIG.7 TOMATO JUICE
Iron
Tin
Ascoloy
Nickel
Aluminum
Enduro and Monel Metal
Bronze
Copper
Loss Mgms. Per Sq. Ft.
1500
1200
900
600
300

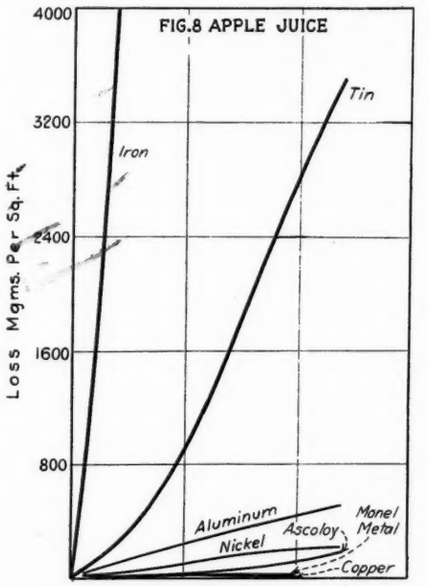


FIG.8 APPLE JUICE
Tin
Iron
Aluminum
Ascoloy
Monel Metal
Nickel
Copper
Loss Mgms. Per Sq. Ft.
4000
3200
2400
1600
800

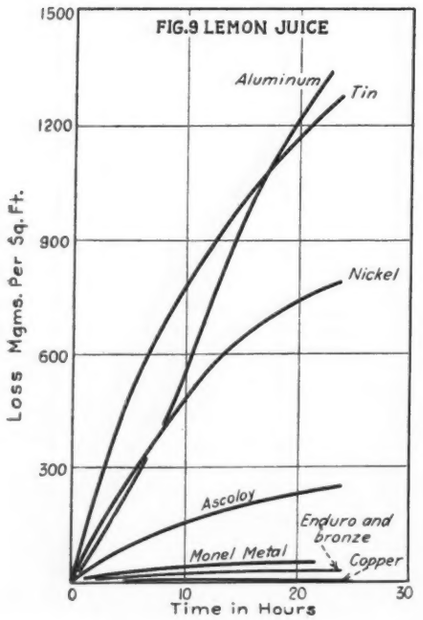


FIG.9 LEMON JUICE
Aluminum
Tin
Nickel
Ascoloy
Enduro and bronze
Monel Metal
Copper
Loss Mgms. Per Sq. Ft.
1500
1200
900
600
300
0
10
20
30
Time in Hours

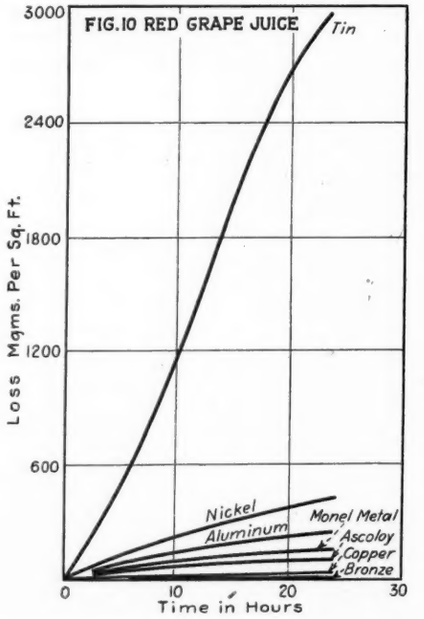


FIG.10 RED GRAPE JUICE
Tin
Nickel
Aluminum
Monel Metal
Ascoloy
Copper
Bronze
Loss Mgms. Per Sq. Ft.
3000
2400
1800
1200
600
0
10
20
30
Time in Hours

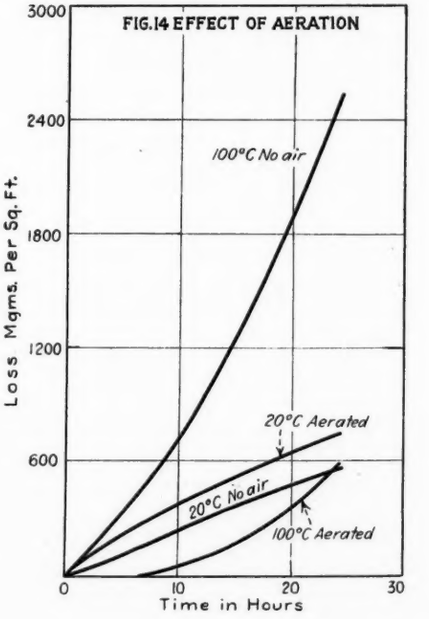
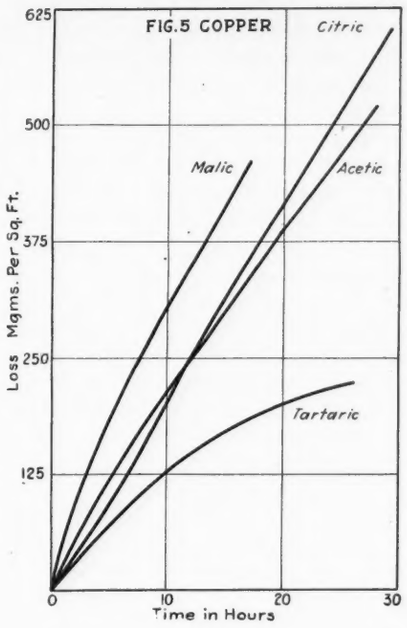
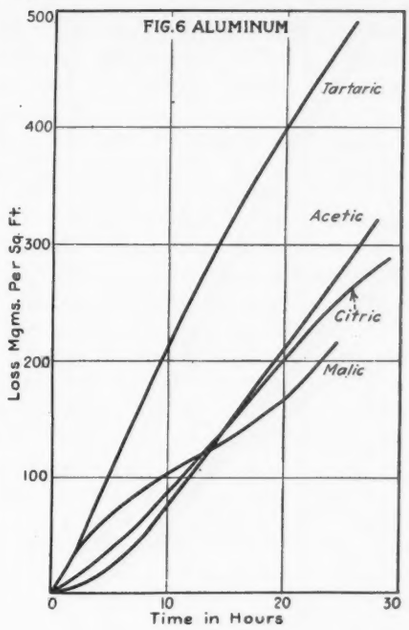


FIG.14 EFFECT OF AERATION
100°C No air
20°C Aerated
20°C No air
100°C Aerated
Loss Mgms. Per Sq. Ft.
3000
2400
1800
1200
600
0
10
20
30
Time in Hours

for malic and citric and 1.12 per cent for tartaric acid. The strips of the various metals used were suspended in the solutions at the boiling point in the manner previously described and the weights were taken in duplicate at 5, 10, 15, 20 and 24 hours in order to determine the loss in weight for each period of immersion. Extreme care was taken in washing and drying the strips in order to remove adhering solution and to prevent oxidation of the metal during drying.

The losses in weight were recorded in milligrams per strip and were then calculated to loss in milligrams per square foot and also to depth of penetration per month (in hundred-thousandths of an inch). The more important data have been presented in Figs. 1 to 6 inclusive, in which the curves are given in terms of milligrams loss in weight per square foot plotted against time.





It will be noted that most of the metals dissolved more rapidly in citric acid than in tartaric acid in spite of the fact that, chemically, tartaric acid is the more highly ionized, or the "stronger," of the two. Aluminum was an exception to this rule, being more soluble in tartaric than in citric acid (see Fig. 6). In tartaric acid copper tended to become passive—that is, corrosion became slower with time. There was little evidence of such a condition with the other metals and acids.

The order of resistance of the metals varied somewhat with the acid used. Thus in citric acid the order of resistance (most resistant first) was: aluminum, Monel metal, copper, nickel, and bronze. In tartaric acid the order was Monel metal, copper, bronze, aluminum, and nickel. In both acetic and malic acids copper dissolved more rapidly than did aluminum. The relative rates of solution of copper in 0.15 normal solutions of citric, tartaric, malic and acetic acids are given in Fig. 5 and of the aluminum in the same acids in Fig. 6.

The data indicate that the relative corrosive action on the metals varies with the acid used and the action of acids varies with the metal used. In other words it cannot be said that citric acid is more active in dissolving metals than is tartaric, acetic or malic; in making any such statement the metal used must be specified. Similarly of the metals studied in these experiments it cannot be said that the order of their resistance will be the same in all acids; the kind of acid used must be specified.

Comparison of Various Juices—The following filtered juices were used after the technique previously described for the pure acid solutions:

Juice	*Deg. Brix.*	*Per Cent*	*Acid*
Tomato	10	0.486	citric
Apple	14	0.28	malic
Lemon	10.8	5.22	citric
Red grape	20.2	0.75	tartaric
White grape	18.0	0.45	tartaric

The temperature was maintained approximately at the boiling point throughout the experiments.

The more important data are given in Figs. 7 to 13 inclusive. It will be seen that in tomato juice copper was most resistant to corrosion and iron least resistant, the order being: copper, bronze, Enduro and Monel metal, aluminum, nickel, Ascaloy metal, tin, and iron. In apple juice the order of solubility was: copper, Monel metal, Ascaloy, nickel, aluminum, tin, and iron. In lemon juice scarcely enough copper dissolved in 24 hours to be weighed. The order of resistance in this juice was: copper, Enduro and bronze, Monel metal, Ascaloy, nickel, tin, and aluminum. In red grape juice bronze was slightly less soluble than copper and the order of resistance was: bronze, copper, Ascaloy, Monel metal, aluminum, nickel, and tin. In this juice the aluminum was less soluble than the nickel, the reverse of the condition in other juices.

The results just discussed are given in Figs. 7 to 10 inclusive. The data have been arranged according to the effect of the juices on copper and aluminum in Figs. 11 and 12. In lemon juice copper was only slightly attacked, but in grape juice the action was somewhat more pronounced and more rapid in tomato juice than in other juices. After 10 hours the copper appeared to become passive in the apple juice. It must be noted that the data for copper are plotted on a scale 60 times as great as the data for aluminum, meaning that the dissolving of the aluminum in all of the juices was far more rapid (50-60 times) than of the copper.

It would seem from the data presented in Figs. 6 to 12 that it is of no particular value to plate copper kettles with tin in order to protect them from the action of fruit juices, as the tin is more soluble than the copper, at least under the conditions of the experiments made by us. As shown in later data, however, copper if allowed to remain wet between periods of use develops a film of easily soluble material, probably copper oxide, and the solubility of the metal is greatly increased thereby. Bronze, an alloy of copper and tin, proved very resistant in all of the tests. Nickel in most tests showed good resistance to corrosion, as did also Monel metal. Enduro alloy proved somewhat more resistant in these tests than Ascaloy alloy, although both were more resistant than tin.

It is realized that other considerations than resistance to corrosion in fruit juices also affect the choice of metal for any particular place of equipment, consequently this fact must not be forgotten in selecting the metal for a given purpose. As with the pure acids, corrosion of a

given metal varied with the juice used and for different juices the order of solubility of the metals used in these tests varied (see Fig. 13 and also Figs. 6 to 12).

Effect of Exposure to Air Between Immersions in Liquid—In commercial practice jelly kettles and vacuum pans are washed at the end of the day's run and allowed to remain wet for some hours. Often noticeable corrosion with the formation of salts or oxide of copper is evident in such equipment. Undoubtedly this condition accounts for much of the corrosion of copper equipment used for the preparation of foods.

Strips of copper were wet with a fruit juice and allowed to stand 4½ and 10 hours in the air while other strips were allowed to stand dry in the air; all were then placed in fruit juice and heated to the boiling point for the same length of time. The quantity of copper dissolved per square foot of surface on the strips that stood dry was 24.8 milligrams; on those that stood wet 4½ hours, 74.3 milligrams, and on those that stood wet 10 hours, 77.6 milligrams. The effect of standing wet is evident from these tests.

Effect of Coloring Matter—No strictly comparable data of the relative rates of corrosion of metals in white grape juice and in red grape juice were obtained, but indirect comparisons and observations on the general behavior of the metals in the two juices indicated somewhat greater solubility in the red juice.

Effect of Oxygen Supply—When air was bubbled through the solutions in a number of experiments, it was found that at the boiling point the air decreased the rate of solution. At room temperature it hastened corrosion very materially. Nickel was the metal used in most of these tests. The effect of oxygen on the rate of solution of aluminum was less noticeable than with nickel (see Fig. 14).

Evidence of Passivity—In tartaric acid, copper and to some extent bronze tended to become passive after a considerable period of contact with the solution. In apple juice also the copper showed evidence of passivity. In grape juice, however, other compounds than the tartaric acid appeared to prevent passivity of this metal. In apple juice Monel metal and bronze; in lemon juice copper, Enduro, Monel metal and bronze tended to dissolve more slowly toward the end of the corrosion period. The causes of decrease in the rate of corrosion were not determined.

Effect of Temperature—Owing to the difficulty met with in maintaining constant temperatures at points below 100 deg. C. the data for the effect of temperature on the rate of corrosion of various metals are not presented in graphic form. However, as would be expected, the rate increased markedly with the temperature over the range observed (100 deg. C. to room temperature).

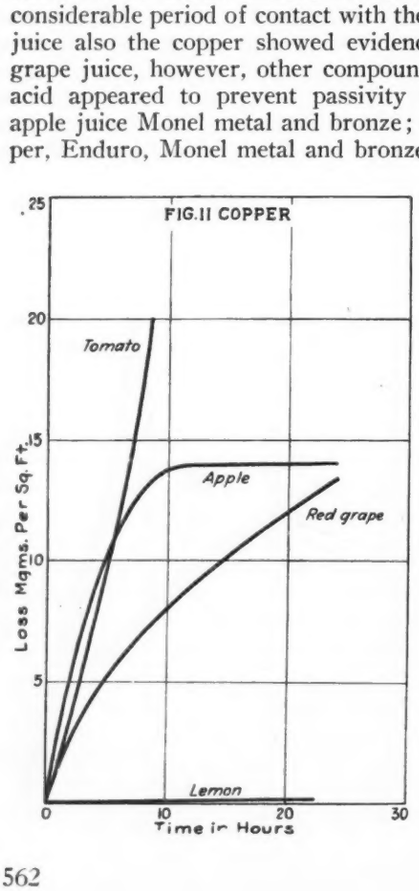
Effect of Sodium Benzoate—Juices often are preserved with sodium benzoate and may later be used for preparation of other products necessitating heating. Copper was found to dissolve considerably more rapidly in lemon juice containing sodium benzoate (0.1 per cent and 0.5 per cent) than in the juice containing no benzoate.

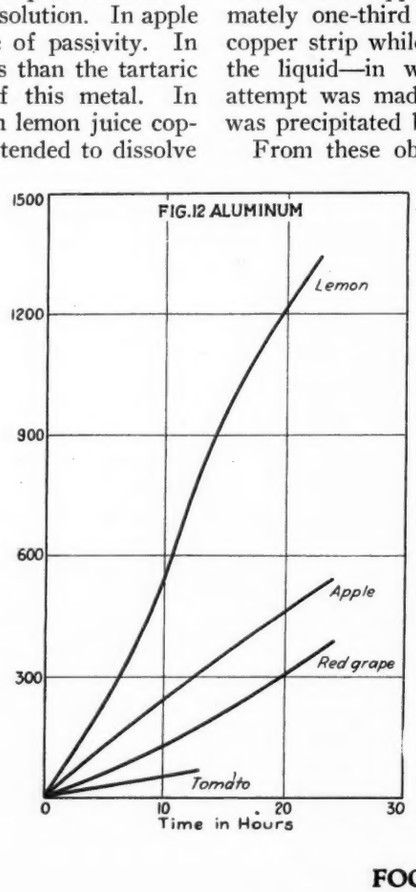
Effect of Pectin—In order to increase the viscosity of lemon juice, 0.5 per cent pectin was dissolved in the juice. The rate of corrosion appeared to be slightly less rapid in the presence of the pectin, but the difference was not considered very significant.

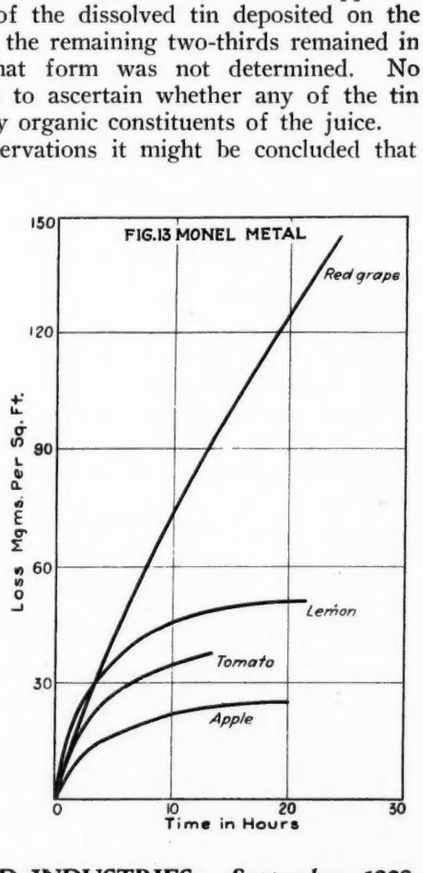
Electrolytic Corrosion of Tin in Presence of Copper—It is customary to coat the interior of copper jelly kettles and vacuum pans with tin in the belief that such plating reduces corrosion of the metal. Usually with use, portions of the copper of the equipment become exposed. It is conceivable that electrolytic action could be set up under such a condition and corrosion of one or the other metal hastened.

In order to test this possibility a strip of copper and one of tin were suspended in tomato juice with the two strips in contact over a small area and the rates of corrosion or metal deposition in the boiling juice determined. The rate of corrosion of tin in tomato juice in the absence of a copper strip also was determined (see Fig. 7). The tin dissolved nearly three times more rapidly in the presence of the copper than it did in its absence. Approximately one-third of the dissolved tin deposited on the copper strip while the remaining two-thirds remained in the liquid—in what form was not determined. No attempt was made to ascertain whether any of the tin was precipitated by organic constituents of the juice.

From these observations it might be concluded that







corrosion of the tin lining of copper kettles used for the cooking of tomato products (and probably other acid food products) would be hastened when portions of the copper of the vessel become exposed.

Comparison of Various Forms of Commercial Copper—Three forms of commercial copper sheet metal were obtained from local dealers—so called pure "sheet copper," "soft copper" and "hard copper"—and the relative rates of corrosion in lemon juice at the boiling point were determined. The "sheet copper" dissolved scarcely at all; the "hard copper" dissolved very rapidly during the very early stages of the test and then corrosion ceased, while the "soft copper" dissolved at a moderate rate throughout the period of the test. Whether these differences were due to differences in chemical composition of the three metals or to differences in mechanical or previous heat treatment was not determined.

Summary—The relative rates of corrosion of several of the metals and alloys commonly used in the food industries were determined in several pure fruit acid solutions and in several fruit juices, as follows:

1. In pure acid solutions the metals and alloys varied somewhat in relative rates of corrosion according to the acid used. Although it is more highly ionized than citric acid, corrosion of most of the metals was less rapid in tartaric than in citric acid. In 0.15 N citric acid the metals and alloys used may be listed as to their resistance to corrosion as follows: aluminum, Monel metal, copper, nickel, and bronze, in the order named.

2. As with the pure acid solutions the rates of corrosion (absolute and relative) varied with the kind of juice used. In apple juice the order of resistance of the metals used was: copper, (most resistant), Monel metal, Ascaloy, nickel, aluminum, tin, and iron. In lemon juice the order was: copper, Enduro, and bronze, Monel metal, Ascaloy, nickel, tin, and aluminum. Tin was much more soluble in all juices than was copper. Copper was surprisingly resistant to corrosion.

3. Aeration increased corrosion of nickel in juice at room temperature and decreased the rate at 100 deg. C.

4. Allowing copper to stand wet between periods of use hastened corrosion.

5. After prolonged contact with the hot juice there was evidence in several tests that certain metals tended to become passive with decrease in rate of corrosion; copper and bronze in grape juice and Monel metal in tomato juice are examples.

6. Sodium benzoate hastened the rate of corrosion of copper in the tests conducted on this point.

7. When in contact with copper, tin dissolved very much more rapidly than in its absence. About one-third of the tin so dissolved was deposited on the copper.

8. So-called "sheet copper" was found to be more resistant to corrosion in lemon juice than either so-called "soft copper" or "hard copper." "Soft copper" was the least resistant.

NEWS IN BRIEF

Cuban sugar, to the extent of 280,000 tons of raws, remains unsold at the termination of the joint foreign sales syndicate and will be returned to the owners. After Oct. 1 a single sales agency, backed by the Cuban federal government, will hereafter market all the sugar from the island.

The third attempt to maintain prices of Swiss packaged processed cheese has been made by the formation of the Verband Schweizerischer Emmenthaler Schachtelkäsefabrikanten in Switzerland. Two previous organizations have broken up because of price cutting. (There are only five important loaf cheese manufacturers in that country.)

Paper milk bottles are now in use in two English dairies. A third plant will soon be ready to use them.

"Sliced bread is one of the biggest developments in the baking industry's history" is the statement of the American Society of Bakery Engineers in the July News Letter.

"Food" is defined in New York State as follows: "The terms 'food' and 'food products' shall include all articles of food, drink, confectionery or condiment, whether simple, mixed or compound, used or intended for use by man or animals, and shall also include all substances or ingredients to be added to food for any purpose." Chapter 207 of the New York laws of 1929.

A reorganization plan has been announced for the Cuba Cane Sugar Corporation in order to avert a receivership as a result of inability to meet the $25,000,000 issue of 7 and 8 per cent convertible debentures due Jan. 1, 1930.

The Copra Milling Corporation, of the Philippine Islands and New York, has been acquired by Spencer Kellogg & Sons, of Buffalo.

Borden will issue 256,458 additional shares to acquire seven new companies, which include: Central Distributors, Inc.; Castenea Dairy Company; the Monroe Cheese Company; Hasselbeck Cheese Company; the Redwing Corporation; Redwing Bottling Works; and Absopure Ice Cream Company.

Corporation Earnings

Corporation	Mos.	Earnings 1929	Earnings 1928	Earnings Per Share 1929	Earnings Per Share 1928
National Biscuit	6	10,181,579	8,355,072	3.88	3.65
United Biscuit	6	839,153	435,602	1.69	1.13
General Foods	6	9,848,057	7,426,630	1.89	....
Corn Products	6	6,866,255	6,026,054	2.36	2.03
Am. Maize Products	6	760,311	.....	23.59(1)	.....
National Dairy Prod.	6	7,638,943	6,525,487	1.85	1.57
Western Dairy Prod.	6	607,305	521,868	....	....
Pet Milk	..	280,940	209,704	.....	.....
Cont. Baking	6	3,424,716	2,084,551	4.84(2)	0.30(3)
Ward Baking	3	1,207,164	1,123,098	....	....
Federal Bake Shops	6	104,972	58,445	....	....
Stahl-Meyer	6	260,936	.....	1.68	.....
Beechnut	6	1,553,242	1,510,484	3.24	3.13
Fleishmann	6	8,828,955	9,529,055	1.95	2.11
Cuyamel Fruit	6	1,665,508	783,984	....	....
Godchaux Sugar	12	903,156	342,053	....	....
Michigan Sugar	12	Loss 611,059	605,134	.....	....
General Mills	12	4,154,786	.....	7.16	....
Penick & Ford	6	950,317	550,837	....	....
American Ice	6	2,107,928	1,607,582	.....	.....
Glidden	6	1,292,013	707,541	2.06	1.14
Wrigley	6	5,211,990	4,907,162	2.89	2.72
American Chicle	6	1,039,167	892,391	2.39	2.05
Canada Dry	6	1,699,566	1,449,191	3.34	3.16
Booth Fisheries	12	324,705	117,728	....	....
Hershey Chocolate	6	4,226,869	3,203,801	.....	.....
International Salt	6	231,298	3,108	3.80	0.05
White Rock	..	589,481	546,728	2.08	1.90

(1) Before 10 for 1 stock split. (2) $3.94 for Class A shares; 0.90 for Class B shares. (3) $0.30 for Class A shares.

A substantial interest in Kraft-Phenix Cheese Corporation has been acquired by Selected Industries, Inc., a New York investment house.

Loft, Inc., New York candy manufacturer, has taken over the management of the 15 drug stores of the Allison chain for a period of 13 years.

The bondholders' committee of the Cuban Dominican Sugar Company has urged immediate deposit of the company's first lien 7½ per cent gold bonds, due on Nov. 1, 1944, in conformance to a plan for providing $4,000,000 in cash to carry the company through its period of depression.

Fleischmann stockholders will hold a special meeting Aug. 31 to approve the offer of Standard Brands, Inc., to purchase all of the assets and properties of the company.

The Margarin Union and Lever Brothers have terminated an old agreement to keep out of each other's fields. A new agreement is now pending that will involve these and other British and Continental margarin and soap makers to avoid competition in the purchase of raw materials, particularly vegetable oils.

Another byproduct of the sugar industry is to be added to products of the Celotex Company, of Chicago. It has recently announced the purchase of a paper mill at New Iberia, La., formerly owned by the Boldt Paper Company, where paper will be made from bagasse

ABSTRACTS · OF · CURRENT · LITERATURE

Electrophoresis. F. Chemnitius. *Chemiker-Zeitung,* May 8, 361-2; May 15, 378-80. The physical chemistry of electrophoretic processes is elucidated and its mathematical laws are formulated. Cells suitable for electro-osmotic and electrophoretic processes are described and illustrated, and practical considerations are stated. One of the most widely applicable arrangements is a cell with two diaphragms (of material chosen according to the intended use), each forming a partition for one electrode. One of the leading applications is in the purification of water, electrolytes being first removed by electro-osmosis and the colloidal impurities being then separated by electrophoretic deposition. The purification can even be made selective to some extent; thus, water for breweries can be largely freed from Mg, leaving desirable salts in the treated water. Another important application is in accelerating the impregnation of hides with tanning agents. Others include removal of proteins from beet juices or sirups in sugar refining; electro-osmotic control of electrochemical oxidations; dewatering sludges or pastes which cannot be filtered, and refining kaolin and other natural clays. Electrophoretic cells can be used singly or in batteries of several, according to the purpose. A battery used in water purification is illustrated

* * *

Solubilities of Metals in Milk. G. N. Quam. *Industrial and Engineering Chemistry,* vol. 21, July, 1929, p. 703. Data presented show the comparison of solubilities of several metals in raw, whole, sweet cow's milk. Values found for aluminum, tin and steel at temperatures from 25 to 75 deg. C. were so small as to be considered negligible. At 80 deg. C. and above, aluminum and tin developed corrosion under the conditions of the experiment. The solubilities of nickel, zinc and copper, in general, increase with rise in temperature to about 90 deg. C. Special chromium steel was found to be the most satisfactory metal of all, as no detectable quantity dissolved in the milk up to 95 deg. C.

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Metals in Dairy Equipment. O. F. Hunziker, W. A. Cordes and B. H. Nissen. *Journal of Dairy Science 12,* 252-84, May, 1929. Laboratory tests have been made of the corrosive effect of washing powders, chemical sterilizers and refrigerating brines on nineteen metals, plated metals and alloys which are actually or potentially useful in dairy equipment. The single metals were aluminum, copper, iron, nickel, tin and zinc; the alloys, Ascoloy, Allegheny metal, Enduro A, Monel metal, nickel silver and an alloy of aluminum with a little manganese. The plated metals were galvanized iron, tinned copper (edges bare and tinned), copper retin, tinned iron (edges bare and tinned), and the aluminum-manganese alloy plated with pure soft aluminum. Various dairy washing powders (mostly alkaline), hypochlorite and other chemical sterilizers, neutralizing lime and refrigerating brines (both calcium and sodium chlorides) were used as corroding liquids. Corrosion was judged by weight loss, appearance of exposed strips and color and precipitate in the liquid. As expected, washing powders were most corrosive to the aluminum metals. Tinned metals (and tin itself to a less extent) also were corroded somewhat. Next came copper, iron, galvanized iron and zinc. Nickel silver was tarnished but not corroded; nickel, Monel metal and the alloy steels resisted both tarnishing and corrosion. Of the chemical sterilizers, sodium hypochlorite was most corrosive. Refrigerating brines corroded iron, galvanized iron, zinc, copper and the tinned metals. Numerical results are tabulated and photographs of tests are shown. Suitability of the various metals, according to the conditions to be met, is discussed in the light of the results obtained.

* * *

Frozen Milk. Viktor V. Winter, *Chemical News,* 138, pp. 321-4, May 24, 1929. By freezing and fractional melting of milk, a separation of its components (fat, protein, lactose and salts) can be effected which is not possible by any other method available for practical use. Fractional melting is facilitated if the milk is frozen in a conical container The ratios of protein : sugar : salt can be greatly altered in milk from which the fat has been removed. Both the theory and the practical application of the method are discussed, tables of numerical data are given, and curve charts are shown.

* * *

Invert Sugar. C. I. Kruisheer. *Chemisch Weekblad,* 26, pp. 254-63, May 4, 1929. A method was published in 1926 for the examination of mixtures containing sucrose, corn sirup and invert sugar, by determining the reducing power and fructose content before, during and after inversion. In practical work, two or three of these six determinations will often give sufficient information. The method has now been modified and simplified by adapting to it the new Schoorl titration method, using Luff's carbonate-alkali copper reagent. The simplified method has been worked out to give several formulas for obtaining an exact idea of the composition of such mixtures. Mixtures made with solid glucose instead of corn sirup also can be analyzed; hence the method can be used for control and testing in the manufacture or examination of chocolate and other confections. As applied to fruit jams, the method is accurate within two per cent, independent of the corn sirup content. This, at least in the higher ranges of glucose concentration, is more accurate than other available methods. Formulas are given for application of the method to jams made from plums, pears, cherries, apples, apricots and various kinds of berries. Calculations and tables of numerical data also are given.

* * *

Cutting Sugar Costs. N. A. Helmer. *Sugar,* 31, p. 141-3, April, 1929. In a previous article an improvement in clarification was described which utilized a Dorr-Petree clarifier. Additional equipment is now described and illustrated, chiefly with the purpose of steam economy. The first step is to introduce pneumatic handling of the powdered bagasse (multiple mill refuse) now used as fuel. In addition to other advantages, this would remove the limitation on boiler size imposed by the smoldering-heap type of bagasse furnace, so that steam-generating facilities of a central could be greatly enlarged, with lowered unit costs. In view of increasing demand for bagasse for wall board and other products, another advantage is that the proposed installation could easily be adapted to burning oil fuel when the bagasse becomes too valuable to burn. Necessary equipment for making such a change in fuel practice is described and illustrated. It includes a Ljungström air preheater installation and the required forced draft and pneumatic handling apparatus. It also would be sound engineering practice to equalize the steam pressure by use of a steam accumulator, such as the Ruths steam storage system.

* * *

Irradiated Ergosterol. Frederick R. Greenbaum. *American Journal of Pharmacy,* 101, pp. 417-25, June, 1929. The Windhaus-Grosskopf method of preparing ergosterol has been found to be simpler than the Smedley-McLean method, and more suitable for the larger scale preparations. The recently discovered spectrum absorption band in irradiated ergosterol, at 247 mu mu, appears to be characteristic of vitamin D and can be used as a means of estimating the ergosterol content of oils. By this means, small amounts have been found in linseed, maize and ground nut oils but not in sesame, peanut and olive oils. Cottonseed oil, containing up to 2.5 per cent ergosterol, is a potential new source. Yeast fat may contain as much as 40 per cent. Experiments in the irradiation of ergosterol are reviewed. The most practical application is the use of irradiated

dried milk in infant feeding, as a preventive of rickets. There is some indication also that feeding of irradiated ergosterol may have an accelerating effect on the healing of bone fractures. Chemical differences between ergosterol and cholesterol are discussed.

* * *

IRRADIATION. Alfred Salmony. *Industrial Chemist,* 5, pp. 236-7, June, 1929. In the irradiation of milk with ultra-violet light to increase its antirachitic vitamin potency, the ozone generated from atmospheric air imparts an undesirable odor and flavor to the milk. The heat effect, if not controlled, also is detrimental. The new Scholl "Vitamilk" cell was therefore designed to effect the irradiation in an atmosphere of carbon dioxide and to carry away the lamp's radiant heat without excessive temperature rise. Thus the conversion of the ergosterol to vitamin is accomplished without the undesirable effects of ozonization and heat. The cell consists essentially of a rubber frame on a flat hollow base through which cooling water is circulated. The thickness of the frame is varied according to the depth of cell desired. The cover is a plate of transparent rock crystal. A laboratory cell, with capacity up to 15 liters per hour, is described and illustrated. A setup for irradiation on a factory scale, using two quartz mercury lamps, also is shown. Operation is continuous, and the rate of flow of milk through the apparatus can be controlled by regulating the gas pressure under which the milk passes through the cell. The temperature rise is not more than 1 to 2 deg. C. The intensity of irradiation can be regulated according to the operating conditions. Other liquids than milk can be treated in this cell.

* * *

BACTERIOLOGICAL STUDIES OF MILKING MACHINES. C. K. Johns and A. G. Lochhead. *Journal of Hygiene,* vol. 29, April, 1929, p. 35. A discussion of the influence of factors other than the sanitary condition of the machine is given and results are tabulated. The efficiency of various methods of cleaning milking machines is given in tabulated form and it is concluded that the chloramine brine treatment is quite as effective as hot water treatment in controlling bacterial contamination and is superior from the standpoint of economy and simplicity.

* * *

EXTRACTORS. *Matières Grasses,* 21, pp. 8542-8, June, 1929. Increasing use of vegetable oil products as substitutes for butter and the animal cooking fats is related, both as cause and effect, to the development and growing application of modern extraction equipment in the vegetable oil industry. As examples of recent advances in plant and machinery for extraction, photographs and descriptions are given of a cleaner and dust remover (rotary drum type); a double vibrating screen; a cottonseed huller; a two-roll grinder; a five-roll grinder (Anglo-American type); a Krupp-Gruson five-roll grinder; a grinder with an upper pair of toothed rolls and a lower pair of striated rolls; a grinder with three pairs of rolls; an open press extractor with five-stage heater installation (Anglo-American type); a charging and discharging press; a battery of frame presses; a frame for round press cakes; a press with rotary frame for square press cakes; a box frame press; an open press (Anglo-American); a press cake trimming machine; a plant for production of cottonseed oil; an automatic continuous press, and an installation of several such presses; a press cake crusher, and an impact mill for grinding press cake. Extraction with solvents is not described. Methods of refining the expressed oil are considered only briefly, with a recommendation that the final refining of edible oils be carried out in vacuum apparatus.

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COCOA BUTTER. W. Springer. *Chemische Umschau auf dem Gebiete der Fette, Oele, Wachse und Harze,* 36, pp. 165-7, June 5, 1929. A method is described for determining, in one test, the turbidity time and the congealing time for fats and hydrogenated oils, with particular reference to cocoa butter. Fats differ widely in these two properties, and different kinds of cocoa butter show characteristic differences, so that the method can be used in testing cocoa butter for its origin (pressed or extracted, from shells or waste) and the amount and kind of adulteration. The method is considered to be adaptable to many kinds of fats and oils, but in its present form it is most useful for cocoa butter. Turbidity time is the time elapsed from the moment the oil or melted fat reaches 50 deg. C. until a mark on the apparatus ceases to be visible through a given thickness of the oil. It is expressed in seconds. Congealing time is the time from the moment this turbidity is reached until the determination of the congealing point (Wolfbauer method) is completed and is expressed in minutes.

* * *

HANDLING SUGAR BEETS. Hugh P. Robbins. *Sugar 31,* 301-7, August, 1929. Prior to 1915 there was no mechanical equipment in use for handling sugar beets. The first successful and permanent handling and storage system was installed at Layton, Utah, in 1915. The first ground level beet dump was put in operation at Far West, Utah, in 1916. Cleaning beets with a rotary screen was also a development of 1916. From these beginnings, mechanical handling spread through the industry. The development has been largely along the line of handling systems utilizing belt conveyors or traveling bridges. In general, belt conveyors seem to be preferable. Future development should include much greater use of car dumpers than at present; most plants are still depending on unloading from railroad highlines. Photographs are shown of some modern installations, including a ground level dump with conveyor, a portable piler, a traveling crane and other equipment. There is such a large saving over older methods that the Japanese have found it profitable to install mechanical handling equipment in their factories in Korea and Manchuria, in spite of the very low cost of labor in those countries.

* * *

COLORIMETRY. G. Greitemann. *Chemische Umschau auf dem Gebiete der Oele, Fette, Wachse und Harze,* 36, pp. 167-8, June 5, 1929. As a new procedure in measuring the color of margarin and other fats, determination of a color number by a comparator method is proposed. This color number is defined as the number of milligrams of free iodine in 10 cc. of an aqueous solution of iodine and potassium iodide, of which a layer 25 mm. deep shows the same depth of color as the sample. If desired, the tone as well as the intensity of color may be stated. In special cases, a Lovibond tintometer or a Zeiss graduated photometer may be needed for this purpose. The iodine color comparison may be made in 25-mm. tubes at various dilutions, or a simple comparator, the construction of which is described, may be used.

* * *

SWISS CHEESE. Paul D. Watson. *Journal of Dairy Science 12,* 289-303, July, 1929. A study has been made of the course of hydrogen ion concentration during the preparation of Swiss cheese as related to the texture. Differences in proteolysis and moisture were correlated with the pH and texture. Variations were produced by making the sample cheese in pairs, using *ga* starter (a *bulgaricus* organism with a mycoderm) in one of each pair, and *39a* starter (an old strain of *Lactobacillus bulgaricus*) in the other. The pH determinations were made with a quinhydrone electrode during the first 24 hours after dipping, and after aging for 3.5 to 5 months. Proteolysis was followed by measuring the percentage of total nitrogen converted to the water-soluble form, and the proportion of this which was changed into amino nitrogen. As measured by this last factor, proteolysis was much greater in the *ga* than in the *39a* cheese. The acidity development during the first day was also notably greater in the *ga* cheese. Texture, as indicated by penetrometer readings, was much harder in the *ga* than in the *39a* cheese. It is therefore evident that a desirable softness of texture does not necessarily accompany the highest degree of proteolysis; in Swiss cheese the contrary is true. Correlation of moisture data with these observations indicates that colloidal structure, as revealed in differences in the binding of water, has an important bearing on texture. Choice of starter, with its influence on pH and proteolysis, is obviously a leading factor.

· CRITICAL · BOOK · REVIEWS ·

ENZYME ACTIONS AND PROPERTIES. By Ernst Waldschmidt-Leitz; translated and extended by Robert P. Walton. John Wiley & Sons, 1929; 255 pp. Price $4.

IN VARIOUS ways enzymes are of considerable importance to the food industry. The digestion of foods by man is accomplished by enzymes of the human body and experiments with enzymes afford the simplest test for digestibility. Some prepared foods are predigested by the action of enzymes. The ripening of meat is due to the action of enzymes. Again, foods may spoil by the action of enzymes naturally existing in the product, or produced there by micro-organisms. A knowledge of enzymes is imperative in many food industries.

No book on the enzymes of the food industries exists, and if one were written, it would be very much like any other enzyme book. What is needed for the food industry is a book that answers all the questions arising in food manufacture. The book of Waldschmidt-Leitz and Walton seems quite fit for the purpose.

By no means is it a popular book. A popular treatment of enzymes is not possible when a real understanding of the processes involved is intended. Especially the "General Section," which deals with the general laws of enzyme action, is quite technical. The chapter on "Enzymic Kinetics" is so technical that the reviewer recommends a more detailed treatment of some parts —e.g., of the equations of p. 32. But the book does not go into minute details. It states the problems, their solution, or the various attempts to solve them, and gives one or two examples. It wastes no time or space in trying to cover the entire literature. It make no effort to be a reference book, but tries to give information about facts and theories rather than about authors.

The book consists of a "General Section" (pp. 1-100), which includes the general laws of enzyme action and enzyme behavior, and also the methods of measuring enzyme quantities, and of purifying and concentrating enzymes. The chapter on preparation and purification of enzymes is quite concise, but presents, in sufficient detail, the latest methods used. The "Special Section" (pp. 101-243) discusses each individual enzyme, its occurrence, determination, preparation, and its peculiarities—e.g., under the heading of proteases are treated: pepsin, lab, trypsin, thrombin, the proteolytic enzymes of the melon tree (papain), of the pineapple, of the pumpkin, of malt, of yeast.

A very large quantity of information is given in this short space, and the allotment to each enzyme except the very common ones must necessarily be small. Yet the reviewer believes that the rennet enzyme deserved more than the one page devoted to it. It is outstanding as a coagulating enzyme, is of great practical importance in the dairy industry, and an enormous literature on rennet has accumulated. In the American literature it is hardly ever called anything but rennet, and it seems strange that the translator never calls it anything but lab, or labic enzyme, or chimosin instead of chymosin. The synonymous use of the words casein and milk albumin probably is an error in translation.

All in all, the book is a concise, modern treatise on enzymes, free from encumbrances of too much literary and historical treatment. It has the common fault of first editions that its chapters need a little more balancing. The translation clings too much to the original text, and one can often feel the German word through the translation, at the expense of the English. But these faults do not interfere with the usefulness of the book.

OTTO RAHN.

* * *

STARCH, ITS CHEMISTRY, TECHNOLOGY AND USES. By Lewis Eynon and J. Henry Lane. 244 pages. Published by W. Heffer & Sons, Ltd., Cambridge, England. Price, 12s. 6d. net.

AN AUTHOR who attempts to cover the subject, "Starch, Its Chemistry, Technology and Uses," within a compass of 250 pages should be judged on the basis of what he has done rather than what he has failed to do, since he has so obviously, yet so courageously, undertaken the impossible.

Judged by the criterion of inclusions rather than omissions, there is much to commend. The chapter on the "Constitution of Starch" sums up our present lamentably inadequate knowledge extremely well and provides, in addition, a reasonably complete historical background although one feels that the space given to certain of the earlier theories might better have been devoted to the phases of the subject which we now believe to have greater claims to validity.

A book of this sort brings home to us in convincing fashion the fact that while science is international, technology is very narrowly national, for while the chapters devoted to "Starch in Relation to Plant Metabolism," "Construction of Starch," "Properties of Starch" and "Microscopy of Starch" are of equal value in this country and in England, where the book was published, the chapters which treat of the manufacture and uses of starch and starch products are of very little value to an American chemist interested in obtaining up-to-date information in regard to the starch industry of his own country. The manufacture of potato starch is described in a chapter of over forty pages, whereas the corn-starch industry, which is practically the only starch industry of substantial importance in this country, is briefly and very inadequately treated in a chapter of ten pages.

The reviewer is not sufficiently familiar with the modern methods for the manufacture of wheat, rice and potato starches to judge the value of the chapters devoted to these subjects. The authors, however, state that much of the information in regard to potato starch manufacture is derived from a book published in 1897 and certainly the information given in regard to corn-starch manufacture is not accurately descriptive of modern practice in that industry.

A fair judgment in regard to the value of this book to the American chemist would give it an excellent rating on those chapters devoted to the pure science aspects of the subject, but would rate it as of no practical value to the searcher after information in regard to the American starch industry.

CARL S. MINER.

· GOVERNMENT · PUBLICATIONS ·

Documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, D. C. Send cash or money order; stamps and personal checks not accepted. When no price is indicated pamphlet is free and should be ordered from bureau responsible for its issue.

Commerce Yearbook, 1929, Vol. I—United States. $1. Compiled by the Bureau of Foreign and Domestic Commerce from statistics gathered by various branches of the government for industries in the United States. Contains chapter on agricultural products and foodstuffs which gives important figures through 1928. Vol. II, to be issued shortly, will deal with conditions in foreign countries.

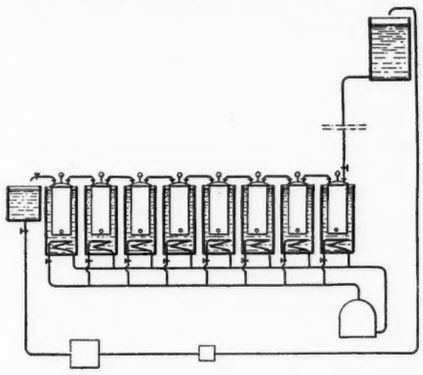
Foreign Trade of the United States, 1928. Bureau of Foreign and Domestic Commerce Trade Information Bulletin 637. Ten cents. Gives import and export figures for the calendar year 1928, including tables on foodstuffs.

Recommended Ice-Cake Specifications. Department of Commerce Simplified Practice Recommendation R96-28. Five cents. Specifications as to weights and sizes of ice cakes for domestic refrigerators recommended for the industry by a conference of manufacturers, distributors, and users.

U. S. Patents Relating to Pest Control, by R. C. Roark. A review of patents giving number, date, subject, patentees, and assignees, and a short abstract of each patent. Issued monthly in mimeographed form by the Bureau of Chemistry and Soils, U. S. Department of Agriculture. Available for 1928 and through July, 1929.

· SELECTED · PATENTS ·

Process of Manufacture of Preserved Fruits — Augustin A. F. Rambaud, of Apt, France. No. 1,717,258. June 11, 1929—Bleached fruit is placed in a series of containers hooked up serially as in the cut and sugar sirup is diffused through them from the overhead tank, passing



out at the end, where it may be concentrated for a second use. Each receptacle containing the fruit is held in a water bath heated by coils as shown in the figure. New fruit is placed in the last unit in the series while the finished preserved fruit is taken off at the first unit in the series. A difference of 5 deg. Bé. per unit will occur between the incoming sirup and the outgoing sirup.

* * *

Beans Baked in Cans — George M. Bartlett, of Merchantville, N. J., to Campbell Soup Company. No. 1,718,187. June 18, 1929—Oven baked beans are produced in the following manner: Beans are soaked in cold water for ten hours, then put over the picking table, after which they are blanched without breaking the skin, then filled into the cans with a piece of pork. About 80 per cent of the full capacity of the can is utilized. Sauce is next placed in the can. They then travel through a continuous oven at a temperature of about 450 deg. F., for a period of from 15 to 20 minutes although a longer time may be used if the temperature is lowered. Water is then added to them to compensate for the loss by evaporation. The next step is hermetic sealing and sterilization for 1¼ hours at a temperature of 250 deg. F.

* * *

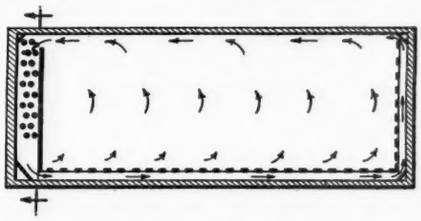
Continuous Prover and Baking Oven —J. E. Pointon, of Peterborough, England, to Baker Perkins Company, of New York. No. 1,716,460. June 11, 1929—A continuous oven and proof-box illustrated by the diagrammatic drawing in which *a* is the prover and *b* the oven. Dough from the molding machine is placed on the trays at *h* or at *r* and travels the circuit of the proof-box or passes directly into the oven and after baking is removed at the opening *j* and the loaves are deposited on the continuous conveyor *k* for removal to the cooling room.

* * *

Preparing Vitamins—Aage W. Owe, of Oslo, Norway. No. 1,715,945. June 4, 1929—A method of preparing vitamin concentrates from marine fats so that persistent emulsions may be avoided. 1.4 kilograms of caustic lime is slaked in water and added to 10 kilograms of fish liver oil previously heated in an inert gas atmosphere of 80 to 100 deg. C. The mass is left standing for 18 to 20 hours at this temperature. The resulting calcium soap is ground to a powder and then digested with 20 kilograms of cotton oil at 40-50 deg. C. for 20 to 24 hours and then separated by filtration.

* * *

Cold-Storage System — Joseph F. Hanrahan, of Long Island City, N. Y. No. 1,717,683. June 18, 1929—A special arrangement of a cold-storage room with

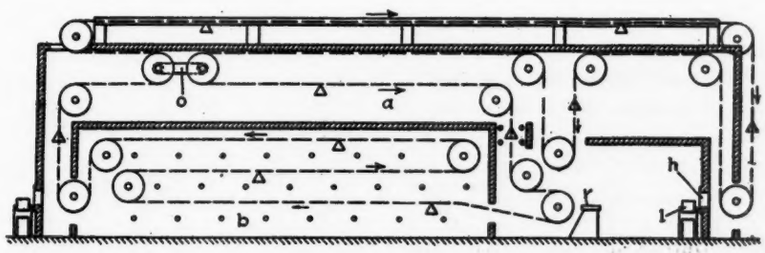


bunker coils at one end and a slatted floor held a short distance above the true floor to permit proper circulation of cold air.

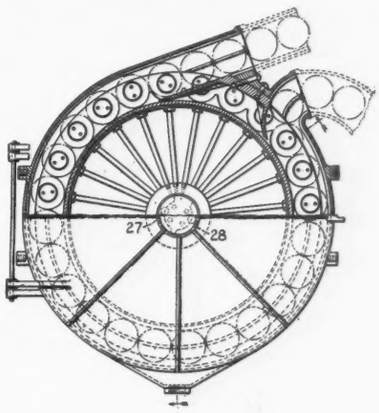
* * *

Blanching Vegetables With Acetylene and Ethylene—R. B. Harvey, of St. Paul, to University of Minnesota. No. 1,721,595. July 23, 1929—The usual slow method of blanching celery, which normally requires many weeks, may be done in a few days with a mixture of acetylene and ethylene liberated in the atmosphere surrounding the vegetable in concentrations of from 1 part in 100,000 up to 1 part per 100. A temperature of 65 to 75 deg. F. is most favorable. Self-blanching varieties of celery will blanch in four to seven days while the green varieties will blanch in eight to twelve days.

* * *



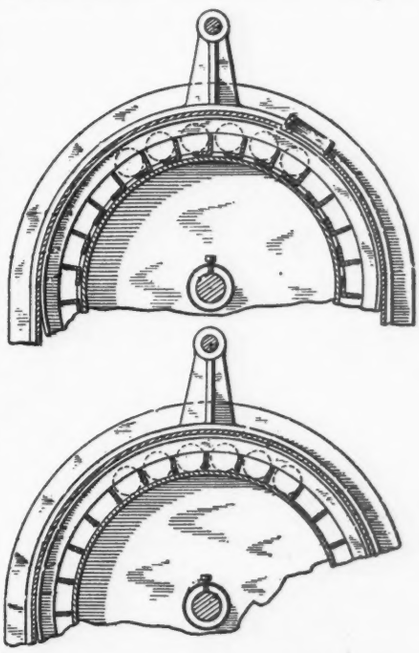
Automatic Can Washer — Arthur N. Omsted, of Cedarburg, Wis. No. 1,717,998. June 18, 1929—A mechanical can washer in which the cans flow down-



ward and around the circle, being discharged near the same point at which they enter. The washer is set at an angle of about 30 deg. from the vertical. The spokes of the spider are hollow tubes and at point 27 receive water which is sprayed into the cans. Whenever the spokes are in contact with the space at 28, steam is sprayed into the can to heat them and partially sterilize them.

* * *

Continuous Adjustable Agitating and Non-Agitating Cooker—C. H. Keeney, of Milwaukee, Wis., to Berlin-Chapman Company, of Berlin, Wis. No. 1,721,562. July 23, 1929—A continuous cooker for

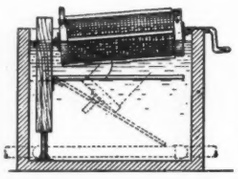


tin cans possessing the quality of being able to agitate or hold the cans quiescent during the process of their travel through the cooker. It is accomplished by having the central drum of the reel separate

from the longitudinal bars. Where the longitudinal bars are made of angle iron, as is customary in this type of cooker, the cans travel with the reel rotating but once per revolution; but when the longitudinal bar is composed of a flat bar, so that the can will rest upon the central drum, any desired degree of motion can be imparted to the can by rotating the drum independently of the bars. Reference to the drawings will show how this is accomplished.

* * *

New Lye Process for Peach-Peeling—Moses Barody, of Albany, N. Y., one-half to Charles H. Andros, of Nassau, N. Y. No. 1,717,647. June 18, 1929—A quick method of lye peeling of peaches which are either ripe or slightly below ripeness. They are first chilled to a temperature between 40 deg. F. and freezing point, then submerged in a boiling lye solution containing from 6 to 15 lb. of lye to 60 gal. of solution. The peaches are held in a sieve-like cylinder and rotated for a few seconds, usually not more than eight. The container is then removed to a separate rack and sprayed with water at a pressure of not less than 80 lb. per square inch, which removes the last traces of the skin of the peaches.

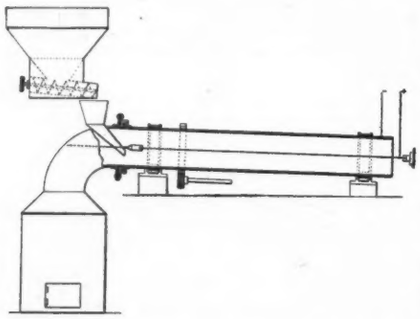


* * *

Fruit and Vegetable Washer—Rudolph J. Stepich, of Stockton, Calif. No. 1,716,712. June 11, 1929—A continuous fruit and vegetable washer consisting of an inclined conveyor with the lower end submerged in a tank of water. During the ascent of the objects being washed they are sprayed with a high-pressure water spray and at the top of the incline fall off into a receiving container and at the same time are subjected to an air blast to dry them.

* * *

Smoked Salt—J. N. Alsop, of Owensboro, Ky. No. 1,719,354. July 2, 1929—Describing the method of manufacture of smoked salt, in which the salt is passed through a rotary kiln through



which wood smoke passes. Electrodes are arranged in such a way that electrical precipitation of the smoke takes place upon the salt.

* * *

Oil Extraction Process—R. O. Boykin, of Los Angeles, Calif., to N. R. Vail, of Los Angeles. No. 1,721,686. July 23, 1929—The process of continuous extraction of cottonseed, soya beans and other oil bearing materials, characterized by the use of solvents of proper physical character, and also by its being carried out in an atmosphere of an inert gas, carbon dioxide, which is obtained from flue gas.

* * *

Determining Acidity by Pills—J. H. Buchanan of Ames, Iowa, to American Bottlers of Carbonated Beverages, Washington. No. 1,721,809. July 23, 1929—A method of determining the acidity of a measured amount of liquid by successively dropping in standardized pills, which contain known amounts of alkali, plus brom phenol blue as an indicator.

* * *

Food Package—George G. Barber, New Rochelle, N. Y., assignor to Continental Baking Company, Wilmington, Del. No. 1,705,849. March 19, 1929—A heavy cardboard container with a transparent paper top in which cakes may be effectively displayed as well as protected from the atmosphere. The contents cannot be removed without destroying the container.

Copies of Patents

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

Photostatic copies of foreign patents may be obtained at the same address, prices being forwarded on application.

Method of Dehairing Carcasses—C. T. Walter, of Chicago, to Swift & Company, of Chicago. No. 1,721,610. July 23, 1929—The method consists in coating the carcass with a hot mixture of 65 parts resin, 30 parts pitch and 5 parts paraffin. It is then sprayed with cold water which hardens the coating. The coating may then be stripped off by hand and takes all of the hairs with it. Separation of the hair from the coating is made by melting and filtering.

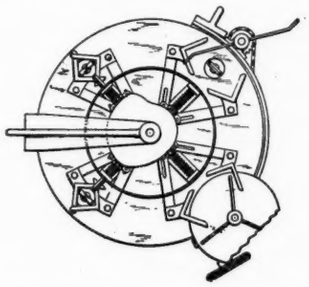
* * *

Automatic Whole Tomato Filler—C. H. Ayars, of Salem, N. J., to Ayars Machine Company, Salem. No. 1,719,580. July 2, 1929—An automatic machine for filling whole peeled tomatoes into tin cans.

* * *

Preparing Animal Carcasses—P. C. Smith, of Chicago, to Swift & Company, of Chicago. No. 1,719,030. July 2, 1929—A new method of preparing animal carcasses to prevent the distortion of muscles occurring in the old method of hanging and chilling the carcass in the hung position. The theory is that the unnatural stretching of the muscles has the effect of making the meat tougher, and of poorer appearance. In the new method, the carcass is split in half and laid upon a wooden frame in such a way that all muscles and bone structures are in the normal, relaxed position. They are then hooked in this position and chilled.

Tomato-Coring Machine—Charles H. Ayars, of Salem, N. J. No. 1,717,827. June 18, 1929—A continuous mechanical tomato corer designed primarily to work in conjunction with the Ayars tomato



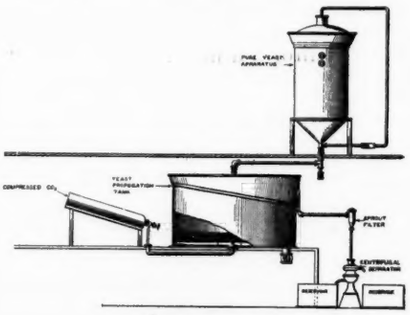
trimmer. In the tomato trimmer the stem end of the tomato is carefully sliced off auomatically, leaving a flat surface on which the tomato rests. While still resting on the flat surface it passes onto the coring machine, where it is seized by a pair of grips and held in proper position while a pair of revolving pincers rise from below and bite out the core of the tomato.

* * *

Yeast from Sulphite Liquor—Gustav Olof Wolfgang Heijkenskjold, of Stockholm, Sweden, to Aktiebolaget Bästa, of Stockholm. No. 1,703,272. Feb. 26, 1929—A description of a process for manufacture of high-grade yeast from waste sulphite liquor from wood digestion, consisting of the following steps: hot waste liquor is aerated and cooled to 90 deg. C.; neutralized with limestone under aeration; lime is added to produce an alkaline reaction after twelve hours' aeration; sedimentation for twenty-four hours; decantation; further neutralization with sodium carbonate; further aeration; addition of the treated sulphite liquor to a special preparation of the yeast, which is then filtered through malt sprouts; fermentation with vigorous aeration; separation, washing and pressing of the yeast. Detailed directions are given for the special nutrition of the seed yeast culture.

* * *

Yeast Manufacture—Lucien Lavedan, of New Orleans, La. No. 1,718,910. June 25, 1929—Describes a method of making yeast in which carbon dioxide is



utilized to agitate the fermenting liquid and also to cool it. Method of making yeast cakes also described. When they are frozen by carbon dioxide, called carbonated yeast, they are said to retain baking strength as well as other qualities for a period of approximately two months.

MANUFACTURERS' · NEWS · AND · EQUIPMENT

A New Shipping Container For Citrus Fruits

A CONTAINER new to citrus fruit shippers, made its appearance during the past few months in the form of an open-mesh woven fabric bag, made by the Chase Bag Company, for the shipping and marketing of oranges, grapefruit and lemons. Known in the produce field as Saxolin, this type of open mesh bag has been used extensively for the transportation of onions for the past fifteen years.

Nearly all of the citrus fruit consumed in the United States is grown in Florida and California and because 75 per cent of it is transported a distance equal to two-thirds the breadth of the continent, transportation charges enter largely into the price the consumer pays for oranges, grapefruit and lemons.

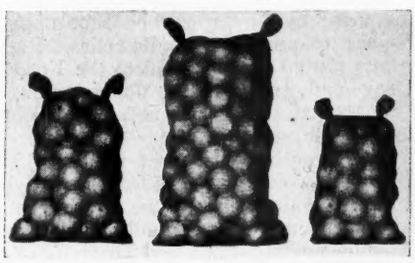
The average wooden fruit crate weighs 7½ to 8 lb. each while the crate-size Saxolin bag adds 8 oz. to the shipping weight of the fruit. In a minimum car from California the wooden shipping container adds 3,600 lb., or 10 per cent, to the freight charges, at a citrus fruit rate of $1.55 per 100 lb., or a charge of $50 per car for merely transporting the container. The same weight-ratio applies to shipments from Florida.

All shipments that have been made during the past crop season to demonstrate the carrying qualities of this package have carried the fruit to destination in a condition equally as good as, and in some instances in better condition than, similar shipments in wooden boxes.

The first cost of the bag is less than one-half the cost of the box, and the packing cost is considerably lower. The ventilation provided by the open mesh bag plays no small part in the preservation of the fruit in transit. The fruit does not sweat, and any bruised or decaying fruit is dried by the circulation of air through the open mesh of the bag.

The smaller sized bag, as a consumer's package, affords a new way of merchandizing oranges and grapefruit. Several carloads of oranges were taken from the original box-size bags and put in consumer-size bags holding one-tenth box, or an average of 20 pieces of fruit, making volume sales larger than the usual sales of dozens and half-dozens. The success of the plan prompted trial of the system in scattered cities in other sections of the country with the result that this manner of marketing oranges and grape fruit holds great promise.

Saxolin Bag for grape fruit—crate, half crate, and one-tenth crate sizes

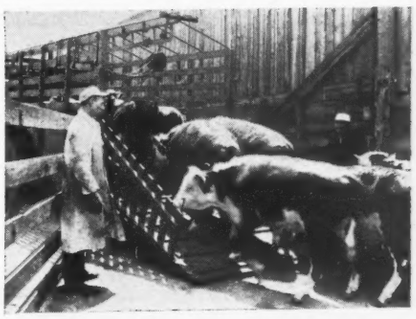


New General Utility Trailer

A NEW light trailer model of 3-ton capacity, known as the Fruehauf "FLYER," announced by the Fruehauf Trailer Company, of Detroit, is an all-purpose unit for general-utility haulage for operation with light motor trucks.

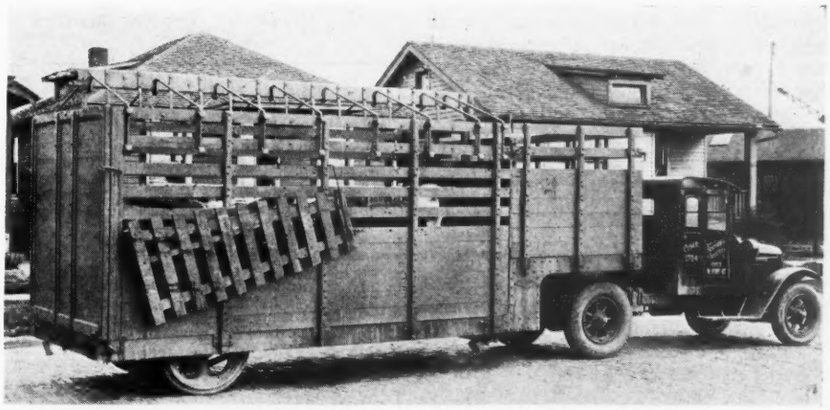
A fifth wheel provides a flexible connection between truck and trailer. A rigid connection here would make a rigid 6-wheeled unit of the truck and trailer which in passing over a depression in the road, would tend to lift the two center wheels clear of the road surface, and would impose a strain on the center of the unit, especially on the connecting device. The fifth wheel permits all six wheels to follow the contour of the road without strains on any part, and also prevents the trailer body from tipping.

When the truck is separate from the trailer, the lower half of the fifth wheel, attached to the truck, tilts naturally to the rear. On this broad inclined plane the trailer slides easily to proper position and automatically locks as the truck is backed underneath it. The operation of connecting or disconnecting can be completed in 30 seconds. The main or lower portion of the fifth wheel is attached to the truck. The upper half mounted on the trailer is included as a part of its equipment. When the trailer and truck are disconnected, the trailer stands on substantial supports, but if operated as a permanently connected unit, the supports are unnecessary.



The heavy end gate is lifted by a chain hoist on a monorail that also can be used for moving heavy loads

Fruehauf's New "Flyer"



Late Publications

Packing Plant Equipment. International Nickel Company, 67 Wall St., New York City—Profusely illustrated folder showing the uses of nickel and monel metal in packing houses together with a buyers' guide to places where the equipment may be purchased.

Vacuum Pan Performance. A. G. Nielsen Company, Chicago—Survey of the performance of a Pfaudler model B vacuum pan in processing fruits at the Hudson Valley Pure Foods Company. Survey No. PS11KM-M.

Stokers. Combustion Engineering Corporation, 200 Madison Ave., New York City—A well illustrated catalog showing the design of the C. E. multiple-retort stoker for large power plants. Also catalog describing type K underfeed stoker, giving illustrations and typical evaporative tests for this stoker which is used under small boilers.

Bread Slicers. Speedee Slicer Corporation, Cleveland, Ohio—Leaflet describing the Speedee slicer for bread in institutional kitchens.

Refrigeration. Frick Company, Waynesboro, Pa.—Bulletin 148-B illustrating businesses and industries using refrigeration.

Automatic Package Tyer. B. H. Bunn Company, 7329 Vincennes Ave., Chicago—Catalog describing the Bunn package-tying machine for tying bundles with cotton twine.

· NEWS · ITEMS ·

Forecast of Fall Sales Continues Favorable

THAT good sales conditions have been maintained by the food products industry in the country as a whole during the current summer is indicated by reports received from the members of the Council on the Trend of Business, an organization composed of 5,600 leading executives in all lines of business and industry, of whom more than 700 manufacture or distribute food products. The volume of business in the food industry, in the opinion of these men, at the close of August was on a plane about 2 per cent above that being maintained at the close of July, and was about 3 per cent above the volume of business at the close of last August.

Every section of the country reports a gain in the current volume of business in food products as compared with the close of August last year. The greatest yearly gain is reported by the members of the Council doing business in the St. Louis section, with a gain of 6 per cent over last year. The New York, South Atlantic, and East South Central sections report current business of about the same proportions as at this time last year.

The members of the Council express the opinion that the general outlook for the next three months is very good. For the country as a whole it is expected that the average volume of business for the next three months will be about 5 per cent above that at the close of August, and will exceed the volume of business during the same 90-day period last year by about 3 per cent. In other words, the manufacturers and distributors of food products look forward to a comparatively good volume of business during the fall months.

The near future outlook appears to be best in the St. Louis and Middle Atlantic sections but every section reports business expectations of greater proportions than that witnessed at either the close of the current August or that of August a year ago. As far as the food products industry is concerned the future is bright in every section of the country.

The improved conditions in agriculture, both as to crops and in the general outlook inspired by the activities of the Federal Farm Board, continue to dominate the general economic horizon. Farmers realize that it is too early as yet to gage correctly the value of The Agricultural Marketing Act, but they do feel that the Federal Farm Board will go a long way toward placing the distribution of farm products on a sound basis, comparable with the best methods being applied to the distribution of manufactured products. Other favorable factors in their order of importance are: continued low inventories and volume turnover; a continued high rate of employment, with an ever higher rate as the fall season opens; comparatively easy financial conditions; and a continued high consumer purchasing power.

The uncertain outcome of the tariff revision stands out as the most unfavorable factor on the business horizon, in the opinion of the members of the Council on the Trend of Business. Until the tariff law is finally passed a large proportion of American business will be maintained at a comparative standstill. Other unfavorable factors are: the scarcity of money in rural communities, although this condition seems to be adjusting itself; continued stock market gambling on a large scale; a low level of building construction, which, however, is in a better position than for several months; excessive installment buying; and keen competition engendered by the development of the chain store.

Procter & Gamble Expansion

The Dixie Cotton Oil Company, of Memphis, and the Louisville Cotton Oil Company, of Louisville, have been added to the group of 13 plants already owned in the South by Procter & Gamble.

COMING EVENTS

SEPTEMBER

7—Texas-Oklahoma Association of Operative Millers, Fort Worth.
9-13—American Chemical Society, Minneapolis.
16-18—Wisconsin Bakers Association, Wausau.
19-20—National Preservers Association, Chicago.
23-26—Association of Dairy, Food and Drug Officials, Lincoln, Neb.
23-27—American Bakers Association, Annual Convention, Chicago.
25-27—Pennsylvania Millers' State Association, Harrisburg.
30-Oct. 2—Bread and Cake Bakers Association of Canada, Toronto.

OCTOBER

7-8—Minnesota State Bottlers Association, Minneapolis.
8-10—Wisconsin Buttermakers' Association, Chippewa Falls, Wis.
12-19—National Dairy Exposition (Dairy Cattle), St. Louis.
21-23—International Association of Ice Cream Manufacturers, Toronto.
21-26—Dairy Industries Exposition, Toronto.
24-26—International Association of Milk Dealers, Toronto.
28-30—Fourth Annual Convention, Mayonnaise Products Manufacturers' Association of America, Atlantic City.

NOVEMBER

11-15—American Bottlers of Carbonated Beverages, Atlantic City.
16-22—Pacific Slope Dairy Show, Oakland, Calif.
19-20—National Creamery Buttermakers' Association, St. Paul.
20-22—Association of Ice Cream Manufacturers of Pennsylvania and New Jersey, Atlantic City.

Colorado Increases Lead as Beet Sugar Producer

An analysis of beet sugar production just released by the University of Denver shows that Colorado has increased its position as a producer of the saccharine root. The survey, tabulating a five-year yield of the five principal beet-producing states—Colorado, California, Michigan, Nebraska and Idaho—indicates that the average tonnage per acre of Colorado beets was 12.76, Nebraska being a close second with 12.75. The sugar yield per acre averaged 3,259 lb. for Colorado and for Nebraska 3,226 lb.

According to the analysis, Colorado beets produced more sugar, not on account of higher sucrose content but by reason of more efficient methods of extraction.

The following table is given of the statistical bureau's findings:

Geographic Division	Yield per acre Beets (short tons)	Sugar (pounds)
Colorado	12.76	3,259
Nebraska	12.75	3,226
Idaho	10.06	3,136
California	8.58	3,088
Michigan	7.53	2,025
United States	10.60	2,880

During 1928, the survey reveals, continental United States produced only 4 per cent of the world's total sugar supply and consumed 20.8 per cent.

New Blue Food Dye Approved by Department of Agriculture

An additional food dye has been approved for addition to the list of colors that will be certified by the United States Department of Agriculture, according to a recent announcement by the Food, Drug and Insecticide Administration.

This color, which will be known as Brilliant Blue FCF and which has been known chemically for many years, has been tested both chemically and physiologically and found to be harmless to health and otherwise suitable for food use, according to the federal food officials. Copies of the descriptions, specifications and special analytical methods for these two dyes will be sent upon request to any interested parties. Requests should be addressed to the Food, Drug and Insecticide Administration, United States Department of Agriculture, Washington, D. C.

Two months subsequent to July 15, 1929, this color will be officially placed on the permitted list by the issuance of a supplement to Service and Regulatory Announcements, Food and Drug No. 3.

Quick Freezing of Many Products—New Source of Ethyl Alchohol—The Tariff in the Senate

By Paul Wooton
Washington Correspondent Food Industries

DEVELOPMENTS of freezing processes are looked upon by food specialists in Washington as one of the most significant trends of the day in the processing of foodstuffs. Experimental work now in progress is so promising that the use of this method is expected to increase rapidly and to extend to the whole range of soft fruits and other perishable commodities. This development is expected to have a far-reaching influence on the canning industry and may eliminate most of the butcher shops.

While it is recognized that much would have to be done to build up a distribution system for frozen fruits and meats, it is held that there is no reason why the problems cannot be worked out readily. With the meat prepared for the consumer at the central packing plants there will be material savings of by-products. The average butcher cannot utilize to best advantage the poorer cuts of the carcass or the bones and fat. Under the present system the portion of the bones and fat that go to the ultimate consumer are largely waste.

Ethyl Alcohol From Petroleum

In connection with the tariff on blackstrap molasses much has been heard of late of the successful development of the process for the synthetic production of ethyl alcohol from ethylene gas. Government technicians who have inspected the plant of the Carbide and Carbon Chemical Company, South Charleston, W. Va., predicted that the imposition of a high tariff on blackstrap would only serve to hasten the day when the synthetic product will satisfy all requirements for industrial alcohol.

Packers' Consent Decree

Petitions for modification of the packers' consent decree, which was restored to operative effect by order of the Supreme Court of the District of Columbia on July 24, have been filed by Armour & Company and associated companies. The petitions represent that the legal status of the decree having been cleared up, the economic aspect of the situation merits consideration, contending that new methods of food distribution have removed any necessity that might have existed in 1920 for restricting their operations to meat packing and closely related lines of activity. The claim is made that there is a widespread demand among live stock producers for abolition or modification of the decree.

Opposition to modification of the decree has been voiced by Representative Celler, of New York. In a letter addressed to Mr. F. Edson White, president of Armour & Company, he asserts that if the "big five" were permitted to engage in retail distribution, there would be grave danger of surrendering to them control of the meat supply. The meat-packing companies have just cause for complaint against the entry of retail chains into the slaughtering business, according to Representative Celler, but the only remedy, he said, lies in an amendment of the Packers and Stockyards Act by Congress prohibiting chain stores engaged in interstate commerce from setting up abattoirs and packing plants.

Proposed Tariff Bill in Its Present Form

The foodstuffs schedule of the tariff bill was extensively revised by the Republican members of the Senate Finance Committee. Although its ad valorem equivalent of 33 per cent is slightly less than the average for the schedule as drafted in the House, increases in individual rates are more numerous than in any other schedule of the bill. Thirteen per cent of all increases in rates made by the Senate Committee were in the agricultural schedule. On the basis of 1928 imports, it is estimated that the schedule as received from the Senate Committee will produce a revenue of $86,906,799, compared with the $89,792,910 total for the schedule as it passed the House, the total for the schedule under the present tariff being $60,065,151. Certain changes in other schedules of the bill are also of importance to the food industries.

The reduction in the tariff on sugar presages a bitter fight when the bill reaches the floor of the Senate. As Senator Smoot's scheme for a sliding scale of duties has been rejected, it seems improbable that a higher rate of duty will be written into the law than was carried in the House bill. Indeed, it is questioned here whether the Senate will agree to a rate so high.

The duties on maple sugar and maple sirup were further increased by the Senate Committee. The present rate of 4c. per lb. on the sugar was raised to 7½c. in the House bill and to 9c. in the Senate bill. The duty on the sirup, which was stepped up from 4c. to 5c. in the House bill, has been advanced to 6c. per lb. in the Senate bill.

Whole milk, fresh or sour, which is dutiable at 2½c. per gal. in the 1922 act and at 5c. in the House bill, was increased to 6½c. in the Senate draft. The duty on cream, fresh or sour, was increased to 56.6c. per gal. The present duty of 20c. was raised to 48c. in the House bill. On skimmed milk, fresh or sour, and buttermilk, the rate was increased from 1¾c. to 2.05c. per gal. Condensed and evaporated milk, in airtight containers, unsweetened, rated at 1.4c. per lb. in the House bill, was reduced to 1.3c. per lb. in the Senate bill. The present duty is 1c. per lb. The duty on sweetened condensed or evaporated milk, in airtight containers, 1½c. in the present tariff and 2¼c. in the House bill, was increased to 2¾c. per lb. in the Senate bill. On other condensed and evaporated milk the rate has been successively advanced from 1.375c. to 2c. to 2.53c. per lb. The duty on dried whole milk has been scaled up from 4¾c. in the House bill to 6.083c. per lb., on dried cream from 10½ to 12⅜c. per lb., and on dried skimmed milk and dried buttermilk from 2½ to 3c. per lb. A provision has been added in the Senate bill stipulating that dried skimmed milk more than 3 per cent butter fat and dried buttermilk more than 6 per cent butter fat, shall be dutiable as dried whole milk and that dried whole milk more than 35 per cent butter fat shall be dutiable as dried cream. Increased from 20 to 30 per cent ad valorem in the House bill, the duty on malted milk was raised to 35 per cent in the Senate bill.

The increase from 8 to 14c. per lb. in the duty on butter and on oleomargarin and other butter substitutes provided by the House was not changed by the Senate committee. The specific duty on cheese and substitutes, now 5c., and 7c. in the House bill, was raised to 8c. per lb. by the Senate committee.

The duty on live poultry has been increased to 8c. per lb., from 6c. in the House bill and 3c. in the present tariff. On dead poultry the rate has been raised to 10c. per lb. by the Senate committee. The present 6c.-duty was increased by the House to 8c. on chickens, ducks, geese, and guineas, and to 10c. on turkeys.

Not All Rates Were Altered

Egg duties remain as fixed by the House, which increased the rate on eggs in the shell from 8 to 10c. per doz. and on whole eggs, egg yolk, and egg albumen, frozen or otherwise prepared or preserved, from 6 to 8c. per lb.

Macaroni and similar paste foods, dutiable at 2c. per lb., must pay a duty of 3c. if containing eggs or egg products, under a provision made by the House and accepted by the Senate committee.

Cider remains dutiable at the present rate of 5c. per gal., but the duty on vinegar was increased from 6 to 8c. per proof gal. by the Senate committee.

An elaborate scale of duties is provided for cherries, now dutiable at 2c. per lb. when fresh, sulphured, or in brine and 40 per cent ad valorem when prepared or preserved, including Maraschino.

The duty on lemons was increased from 2 to 2½c. per lb. by the Senate committee but the increase from 1 to 2c. per lb. on limes and from 1 to 1½c. per lb. on grape fruit granted by the House was eliminated. The duty on dried, dessicated, or evaporated prunes was increased from ½c. to 2c. per lb.

The Senate committee retained the increased duties on cocoa and chocolate, which were raised by the House from 17½ per cent ad valorem but not less than 2c. per lb., to 3c. per lb. (net weight) on unsweetened and to 40 per cent on sweetened cocoa and chocolate. Arrowroot starch and flour were transferred to the free list.

Revision of the chemical schedule produced the following changes:

Crude chicle, now dutiable at 10c. per lb., has been transferred to the free list and the duty on refined chicle has been reduced from 15c. to 5c. per lb.

On edible gelatin valued at less than 40c. per lb. the increase from 3½c. and 20 per cent ad valorem to 5c. and 20 per cent ad valorem carried in the House bill was eliminated. The increase from 20 to 25 per cent in the ad valorem rate and from 1½ to 2c. per lb. on gelatin, glue, glue size, and fish glue not specially provided for, valued at less than 40c. per lb., was retained.

Pectin had been added by the House committee at 25 per cent and remains unchanged in the Senate draft. An increase from 2½ to 3½c. per lb. on casein is a compromise. The dairymen asked for an 8c. levy.

The duty on linseed and flaxseed oils and mixtures has been reduced to 3.7c. per lb., which is only 0.4c. per lb. greater than the present rate of duty. The House had voted an increase to 4.16c. in the duty on these oils. The increase of 1c. in the duty on olive oil weighing with the immediate container less than 40 lbs., carried in the House bill, was stricken out by the Senate committee, leaving the duty at 7½c. per lb. The rate on soy mean oil, doubled in the House bill, was reduced to 2.8c. per lb., with a provision that the duty collected shall not be less than 45 per cent ad valorem. The present duty on soy bean oil is 2½c. per lb. Eucalyptus oil, now dutiable at 25 per cent, has been transferred to the free list. Grape fruit oil was placed in paragraph 59 by the House, subject to a duty of 25 per cent.

Progress in Refrigerator Transport

The Silica Gel Iceless Refrigerator Car is being studied as a means of controlled-temperature transportation by manufacturers handling perishables in many lines. Twenty-five of the 31 Silica Gel cars now in existence are in constant use by the Atlantic Coast Fisheries Company. Its fleet is to be increased to 50 cars as soon as the new cars can be built.

Recent experimental shipments include a car of frozen strawberries from Portland, Ore., to Libby, McNeill & Libby, Chicago. The temperature of the car on arrival was 18 deg. F. A full carload of fresh eggs was also shipped in July from Seattle to New York City, consigned to the Pacific Egg Producers. Shipping instructions specified a temperature of 40 deg. F. from Seattle to Buffalo, and 45 deg. F. from Buffalo to New York. Despite the fact that the car was eleven days en route and passed through regions of high temperature in Montana and North Dakota the specified temperatures were maintained. Several carloads of cold packed cherries in barrels were handled from Sturgeon Bay, Wis., to Chicago in July.

An interesting feature of the Silica Gel cars is the increased carrying capacity that they possess. During the year ending June 30, 1929, shipments totaling 405 Silica Gel cars were made that would have required 435 cars had they been made in the ice bunker type refrigerator car.

For the benefit of readers of FOOD INDUSTRIES it should be explained that the advantages of the Silica Gel car over the other type is found in the uniformity of temperature throughout the car and its control. Iced cars can be made to maintain freezing temperatures with the use of salt, but the temperature may, and does, vary with the amount of unmelted ice in the car. Certain types of food, in particular the quick frozen foods, may be seriously harmed by such variations of temperature—even when these variations are below the freezing point of the product itself. It is here that the Silica Gel car is finding its greatest use at present.

Vita-Fruit Products Company Formed

The Matzka process of sterilizing fruit juice is now controlled throughout the United States by the Vita-Fruit Products Company, of San Francisco, formerly known as the Matzka Products Company. As reported in February FOOD INDUSTRIES, the latter concern was formed to take over the business of the Kelly Dry Pure Juice Company, of New York.

The new company has purchased a majority of the stock of the Kelly Company and will operate its New York plant for eastern sales. A plant at Lodi, Calif., will supply the western territory. Heretofore the Kelly company has been purchasing its grape juice from the National Fruit Products Company at Lodi. The Vita-Fruit company has purchased the grape juice plant of the latter and is installing machinery to bottle grape juice by the Matzka process. This process or machine has been the source of much curiosity and comment on the part of manufacturers of liquid products, for it is alleged to embody a method of electrical sterilization, said to be brought about by an electro-chemical action of the acid juice in contact with different metals in a large cylinder. Observations by a representative of FOOD INDUSTRIES, as well as by competent bacteriologists, indicate, however, that heat may also play a part in the process.

The Lodi plant will have a capacity of 1,500,000 gallons of grape juice annually and will freeze it during the peak of the season, storing it until needed for bottling. Concord, Tokay, and blends of both varieties will be used.

Frank Whipple, president of the National Ice & Cold Storage Company, of San Francisco, is president of the Vita-Fruit Company; T. Shewan, of the Shewan family, who are well known in the dry-dock and marine shipping business, is vice-president; R. P. Schwerin is executive vice-president; Lee Jones is managing director; and Dr. W. Matzka is technical advisor. The company is not yet associated with the Associated Fruit Industries but plans are under way to accomplish that end.

Cuban Canned Milk Imports Decreasing

Imports of canned milk into Cuba in 1928 amounted to 43,000,000 lb., a recession of considerable size from the previous annual average of 50,000,000 lb. In explaining the decline in the Cuban purchases of canned milk, two theories have been set forth, one of which is to the effect that the declining purchasing power of the Cuban population is the cause. Naturally any decline in purchasing power is associated with the price of Cuban sugar. Another theory having considerable interest to explain the decline of Cuban milk imports is based on the fact that fresh milk is being produced in increasing amounts in Cuba today.

George S. Ward, of Pittsburgh and Havana, one of the members of the famous Ward family of baking fame, is very active in this development. Mr. Ward maintains residence in Havana most of the year and has extensive properties in Cuba, where he has begun to produce and distribute fresh milk. In this work he has had the co-operation of the Cuban government to a very gratifying extent for the establishment of quarantine regions in order to rid the land of the cattle tic. A big problem to solve in the production of milk in the tropics is that of raising the proper food for cattle, and while success apparently is possible in the future, the fact still remains that most of the Cuban milk is produced on feed, particularly alfalfa meal, imported from the temperate climates of the United States.

Food Machinery Corporation

During the past year the John Bean Manufacturing Company has expanded from a $2,000,000 to a $7,000,000 corporation, including such well-known units as the Anderson-Barngrover Manufacturing Company, Sprague-Sells Corporation, and Stebler-Parker Company. Since its greatest activities are in the food field it has been decided to change the name of the parent company to the Food Machinery Corporation.

The John Bean Manufacturing Company will continue to function as a division of the new parent company, with plants at San Jose, Calif., and Lansing, Mich.

Anderson-Barngrover will operate as the Western manufacturing and sales division with plants at San Jose and

Hayward, Calif., and general offices at 70 Pine Street, San Francisco.

Sprague-Sells Corporation will operate as the Eastern manufacturing and sales division with plants at Hoopeston, Ill., and Buffalo, and general sales offices at 308 West Washington Street, Chicago.

Stebler-Parker Company will continue to operate its Riverside, Calif., plant, and will open a sales office in Los Angeles.

Export offices for the Food Machinery Corporation are located at 70 Pine Street, San Francisco, and 17 State Street, New York.

United Molasses Board

An American board of directors has been recently named for the United Molasses Company, Ltd., of the United States and Cuba. The following have been elected to the American directorate:

Arthur W. Loasby, president of the Equitable Trust Company, director of Warner Sugar, National Distillers, Eastern Alcohol, and other corporations; F. A. Rogers, vice-president, National Distiller's Products Corporation, director of American Medicinal Spirits Corporation, Kentucky Distilleries, Hannis Distilling Company, Kentucky Alcohol Corporation, Eastern Alcohol Corporation, Old Time Molasses Company, Solid Carbonic Company, and others; Maurice Levin; and C. U. Snyder.

Ruling on Proper Labeling of Canned Mixed Vegetables or Fruits

Labels on canned mixed vegetables or fruits should not carry statements or pictures which may mislead purchasers regarding the particular vegetables or fruits in the mixture, according to a notice recently issued to the trade by the Food, Drug and Insecticide Administration of the United States Department of Agriculture. The text of the notice follows:

"There has recently developed in the canning trade a practice of canning mixed vegetables which appears to be becoming more and more extensive. These products are usually designated as 'mixed vegetables' and bear a vignette of a display of a number of vegetables. Investigation shows that in some cases the pictorial designs represent vegetables not present in the cans or fail to depict others which are present. As the Federal food and drugs act defines as misbranded an article of food which bears any statement, design or device which shall be false or misleading in any particular, the use of a vignette on a label depicting vegetables not present in the can in substantial amounts is improper, as is also a vignette which fails to display all vegetables present. Listing the names of the vegetables present is not regarded necessary, but when a list is given it should be complete and include only vegetables actually present. A list correctly stating the ingredients does not serve to correct a false and misleading vignette.

"No objection is raised to the designation 'mixed vegetables' or expressions of similar meaning for products consisting of a number of vegetables. This name, however, or any other which implies vegetables canned in the succulent state should not be used on products containing dried vegetables, unless appropriate declaration is conspicuously made showing the presence of soaked dry vegetables of the variety used. In cases where dried vegetables are used the vignette employed should not pictur the vegetables in the succulent state.

"The general principles set forth here with respect to mixed vegetables are also applicable to labels for mixed fruits."

Label Ruling on "Cherry" Products

Cherry juice sirups and other cherry flavoring preparations which owe their flavor chiefly to cherry pits, oil of bitter almonds or benzaldehyde should not be labeled to indicate that their flavor is due to cherry pulp or cherry juice, say officials of the Food, Drug and Insecticide Administration of the United States Department of Agriculture.

Benzaldehyde, the flavoring principle of the seed of the cherry, bitter almond, apricot and the peach, has an intense flavor and flavoring preparations to which it is added can be diluted to far greater extent than if flavored only with cherry juice. The words Cherry Flavor imply that the flavor is derived from the pulp or juice of cherries and should be so used.

Swift Absorbs Torgerson

Swift & Company has taken over the Torgerson Produce Company, Winlock, Wash., establishing headquarters there for southwestern Washington. The Torgerson company has represented the Swift interests for some time.

Grocery Store Products Expansion

Further growth of the George K. Morrow group of industries is seen in the announcement of the acquisition of the Edward H. Jacob Mushroom Cannery of West Chester, Pa., by Grocery Store Products, Inc. The latter company is the holding company for Toddy, Inc.; The Foulds Milling Company; and Kitchen Bouquet, Inc. The Edward H. Jacob Company is the largest producer of canned mushrooms in the United States.

The board of directors of Grocery Store Products, Inc., includes Robert M. McMullen, chairman; James M. Hills, president of The Foulds Company; H. H. Mills, vice-president of The Foulds Company; Bernard M. Gordon, vice-president of Toddy, Inc.; and Roswell O. Fish, of Beals & Nicholson, attorneys. James M. Hills is also president of Grocery Store Products, Inc.

General Fruit Reorganizes

Reorganization of the executive personnel of the General Fruit Corporation, created on April 1, as a holding company for the Pacific Fruit & Produce Company and the Ryan Fruit Company, has been announced. James O. Gallagher now is chairman of the board of the General Fruit Corporation and president of the Pacific Fruit & Produce Company. George Youell, founder of the latter company, has retired. The General Fruit Corporation plans to centralize all its administrative activities in Seattle, Wash.

McCormick & Company Not Interested in Mergers

Loyalty to stockholder employees is the reason, advanced by McCormick & Company, Inc., of Baltimore, for rejecting all offers to merge the firm with similar concerns in the spice and flavoring extract field. A recent letter from the company accompanying dividend checks for the preferred shareholders sets forth this statement of policy, and also calls attention to the fact, that September will see the fortieth anniversary of the founding of the company.

Canned New Irish Potatoes

As a means of utilizing No. 3 potatoes, which are without a well defined market on account of their small size, the Southern Potato Products Company, Inc., was recently organized and now has a plant operating at Bunnell, Fla. The plant began operation on April 15, 1929, and continued for the balance of the potato season. Potatoes are taken fresh from the field with seldom more than 24 hours elapsing between digger and cannery, peeled, sorted and canned in No. 2 cans. It is asserted that canned potatoes possess a flavor that cannot be obtained by cooking in an open vessel. A. D. Zachary, of both Sanford and Palatka, Fla., is president, and D. W. Tungate is vice-president and general manager of the company.

Loft-Curtiss Merger Off

The series of conferences between Loft, Inc., New York confectioners, and Curtiss Candy Company, of Chicago, makers of Baby Ruth chocolate bars, has been terminated without a proposal from either side, according to a statement from Otto Schnering, president of Curtiss.

PERSONALS

GEORGE L. ALEXANDER will be in charge of the laboratory of the new Springfield, Mo., plant of the Pillsbury Flour Mills. He was previously connected with the Commercial Milling Company at Detroit.

O. A. ANDERSON, of Chicago, has been appointed consulting engineer for Armour & Company, succeeding J. D. Andrew who recently resigned.

S. HENRY AYERS, director of research for the Glass Container Association, has tendered his resignation to take effect in the near future.

W. D. BOST, vice-president of the Orange-Crush Company, of Chicago, is the same Dr. William Dale Bost whose name has been given to the new Bost Tooth Paste that has been extensively advertised in New York. The new dental cream, which has the property of dissolving tobacco stains from the teeth, or from a handkerchief through which tobacco smoke has been blown, is his invention.

H. D. BRIGHAM has resigned as superintendent of the Galeton Dairy Products Company to become manager of the Arctic Ice Cream & Milk Company, Inc., of Ithaca, New York.

F. B. BURKE has been elected president of the Sperry Flour Company and a director of General Mills, Inc. He succeeds R. N. Bishop, who has resigned both offices on account of ill health.

R. S. CALLEN has resigned as secretary of the Southern California Canners Association to become sales manager of the California Sanitary Canning Company, at Los Angeles.

C. O. CARTWRIGHT, formerly assistant in the Department of Horticultural Manufactures at Massachusetts Agricultural College, and more recently with the A. A. Knight Company, of Boston, is factory manager of the Za-Rex Company, Inc., of Boston. He succeeds W. F. Robertson, who joined the Pfaudler Company in July.

F. M. CLIME, formerly of the Freihofer Baking Company, of Philadelphia, is now cake superintendent of Strachman Brothers Company, of Morristown, Pa.

E. B. DEMING, president of the Pacific American Fisheries, South Bellingham, Wash., is a director of Pacific American Associates, Inc., the recently organized investment house that has just been consolidated with Goldman Sachs Trading Corporation.

CHARLES EIKEL, of Armour & Company, has been appointed assistant general superintendent in charge of plants at Kansas City, St. Louis, St. Joseph, South St. Joseph, Fort Worth, and Oklahoma City.

W. R. FETZER has resigned his position as research chemist for the Miner Laboratories and as chief chemist for A. P. Callahan & Company to accept a position as chief chemist in charge of research and development, for the Union Starch & Refining Company, with plants at Granite City, Ill., and Edinburg, Ind. He will be stationed at Granite City (St. Louis). Dr. Fetzer was formerly editor-in-chief of the *Chemical Bulletin*, Chicago.

KARL L. FORD has been appointed acting director of research of the Glass Container Association. He succeeds Dr. S. H. Ayers, who recently resigned.

ROLFE L. FRYE has resigned from the Valier-Sties Milling Corporation and is now chief chemist of Bewley Mills, Inc., of Fort Worth, Texas.

FRANK J. GARDNER, consulting superintendent of Swift & Company, retired in July after 42 years of continuous service with that concern. He will make his home in Claremont, Calif.

H. O. GILMER, formerly of the Larabee Flour Mills, is now in charge of the Cereal Laboratory of the Russell Milling Company, at Russell, Kansas.

F. D. GREEN has been made assistant general superintendent of Armour & Company's plants at South Omaha, Denver, New York, Jersey City, Indianapolis, and Milwaukee.

WILLIAM F. HEIDE, vice-president and general manager of Henry Heide, Inc., New York candy manufacturers, has been elected chairman of the National Food Products Protective Committee. This organization is the board of strategy for defense of foods against the attacks of certain non-food producers. His election followed the resignation of A. M. Kelley, recently elected president of the National Confectioners' Association.

THOMAS E. HOLLINGSHEAD, resigned as chief chemist for Zion Institutions and Industries, Zion City, Ill., on July 1, and is now employed by Griggs, Cooper & Company, manufacturing wholesale grocers, St. Paul.

FRANK A. HORNE, president of the Merchants Refrigerating Company, of New York, received the honorary degree of Doctor of Commercial Science (S.C.D.) from Boston University, Boston, on June 18, 1929. In recommending Mr. Horne for the degree, President D. L. Marsh mentioned particularly his leadership in the development of methods for preserving and storing perishable food products by mechanical refrigeration.

HENRY W. JEFFERS, president of the Walker-Gordon Company, New York subsidiary of the Borden Company, has been named a director of the United Growers of America.

H. J. KOENIG, of Armour & Company, has been put in charge of development work in connection with beef dressing, small stock dressing, hides, fresh beef tongues, selected meats, and freezers.

GEORGE W. MULLEN has resigned his position as director of laboratories for the Anchor Cap and Closure Corporation, at the Long Island City plant of that company, and has organized the Food Products Service Company, in New York City.

ANDREW OSBORN, formerly chemical engineer with the Glass Container Association, is now employed in that capacity by the Anchor Cap and Closure Corporation.

M. HARDIE RANEY is director of laboratories of the Anchor Cap and Closure Corporation, at the Long Island City plant. He succeeds George W. Mullen.

HENRY A. SEHN, president of the Sweets Company of America, has been elected also president and general manager of the Croft & Allen Corporation, one of the oldest candy manufacturers in the country.

FRANK E. SNYDER has resigned as president of the Croft & Allen Corporation, New York candy manufacturers. Mr. Snyder will remain on the Board of Directors.

BENJAMIN S. STEVENS, formerly general superintendent of Bordo Products Company, is now superintendent of production for C. S. Stevens & Son, canners, at Cedarville, New Jersey.

F. D. VAPERA is assistant general superintendent of Armour & Company's plants at South St. Paul, Fargo, Spokane, Sioux City, and Huron, S. D.

ESWORTH VOIGT has resigned from the research department of the Glass Container Association and is now with the Anchor Cap and Closure Corporation as food chemist.

R. N. WATT, vice-president of William Davies Company, Ltd., has resigned as manager of the packing company's Montreal plants. He retains his corporate office to which he has risen in 25 years of service and is also to remain a director of Canada Packers, Ltd.

THOMAS E. WILSON, president of Wilson & Company, has returned from an inspection trip of company properties in South America and England.

C. A. WINKLER has been made secretary of the Southern California Canners Association, at Los Angeles.

OBITUARY

JOHN ANDERSON, general manager of the Pittsburgh Provision & Packing Company, shot himself in his office on the evening of July 18. It is believed that ill-health prompted his act.

ALBERT N. STOLLWERCK, 60, of Camden, N. J., general manager of the Royal Cocoa Company, of Camden, died of heart disease on the beach at Cape May, N. J., on Aug. 25. Son of the famous German chocolate manufacturer, Heinrick Stollwerck, of Cologne, he came to America about 1910 to establish a branch of the business at Stamford, Conn. Disagreement with his father led to severance of business relations, litigation, and later to his becoming chairman of the board of the Brewster Chocolate Company.

SAMUEL S. BRESKY, vice-president of

the Seaboard Flour Corporation, of Boston, died suddenly on July 11 in New York. He also held the same position in the Rodney Milling Company, of Kansas City.

FRANK A. BROWN, president of the Squire Dingee Company of Chicago, died unexpectedly of a heart attack at his home in Wilmette, Ill., August 14. Practically all of his business life from

Frank A. Brown

boyhood on was spent with the Squire Dingee Company, and under his direction it has grown to be one of the four largest pickle companies in the United States. His son, F. Olney Brown, has been associated with him in the business.

T. WALKER CARMAN, of Springfield, Mass., president of the Baker Extract Company, was found dead in bed at the Parker House, in Boston, on July 29.

E. A. ECKERT, president of the Eckert Packing Company of Henderson, Ky., died recently at the age of 50 from heart trouble.

GEORGE R. FOWLER, 65, died in Watkins Glen, N. Y., on July 26, of a heart attack. Although he was a citizen of England, he maintained residence in Havana, Cuba, where he was president of the North American Sugar Company, the Los Hermanas Sugar Company, the Constantia Sugar Company, the Parque Alto Sugar Company, and the Caibarien & Moron Railroad of Cuba.

NORMAN J. GRIFFITH, of George W. Haxton & Son, canners, with headquarters at Oakfield, N. Y., died of a heart attack on July 2, at the Hotel Utica, in Utica, N. Y. He was better known as one of the owners of the Stittville Canning Company, of Stittville, N. Y., the holdings in which he sold about two years ago when he became associated with the Haxton Company.

JOSEPH E. HUBINGER, aged 72, once a large manufacturer of starch, particularly for laundering purposes, with plants at New Haven and Keokuk, Iowa, died July 31 at his home in New Haven, where he has been a paralytic invalid for many years.

CARL F. KEHLOFF, 47, president of the Kehloff Baking Company, of Buffalo, died July 30.

HERBERT O. MILLER, until recently vice-president and general manager of the Columbia Baking Company, died very unexpectedly, in July, at his home near Asheville, N. C., at the age of 62.

J. K. MULLEN, chairman of the board of directors of the Colorado Milling and Elevator Company, died in Denver, Colo., on Aug. 9, at the age of 83. He was active in the affairs of this company at the time of his death, his last illness having been incurred during a business trip that resulted in pneumonia.

A. EUGENE THOMPSON, 66, vice-president and treasurer of the Thompson Ice Cream Company, and treasurer of the Chapell Ice Cream Company, both of Chicago, died in July in Pasadena, Calif., where he had been for the past seven months attempting to regain his health.

PETER A. YODER, who for twenty years had been connected with the Bureau of Plant Industry in agricultural chemical developments, died July 20 of a sudden heart attack at his home in Washington, D. C. Dr. Yoder's work dealt largely with chemical and technologic developments in sugar cane and cane sugar of Louisiana.

· NEW · CONSTRUCTION ·

Factory and Equipment Requirements

Abattoir—J. Allan & Sons, Evans Ave. and 3rd St., San Francisio, Calif., awarded contract for the construction of a 4 story abattoir building to Mission Concrete Co., 247 Turk Ave., San Francisco. Estimated cost $90,000.

Bakery—Acme Pie Co., 2286 East Milwaukee Ave., Detroit, Mich., is having plans prepared for a 2 story, 80 x 200 ft. bakery on Medbury Ave. Estimated cost $75,000. W. E. Long Co., 155 North Clark St., Chicago, Ill., is architect and engineer. Machinery and equipment will be required.

Bakery — M. Chesney, c/o S. Cohen, 134 Branford Pl., Newark, N. J., Archt., will not construct 2 story, 45 x 100 ft. bakery at Jersey and Manor Sts., Harrison. $40,000. Project abandoned.

Bakery—Crown Bakery Ltd., Regina, Sask., plans addition to bakery. Estimated cost $115,000.

Bakery—Dugan Bros., Inc., 161 Abington Ave., Newark, N. J., awarded contract for a 1 story, 70 x 200 ft. addition to bakery to Federal Construction Co., 649 Broadway, Newark. Estimated cost $60,000.

Bakery—Economy Grocery Co., M. Joseloff, Mgr., East Hartford (br. Hartford), Conn., is receiving bids for the construction of a 1 and 4 story, 80 x 200 and 60 x 200 ft. warehouse and produce building. Estimated cost $150,000. Monks & Johnson, 99 Chauncy St., Boston, Mass., are architects.

Bakery—J. Finacchio, 10408 Northern Blvd., Corona, L. I., N. Y., is receiving bids for a 1 story bakery at W. S. 108 St. Estimated cost $25,000. J. J. LaMendola, 19716 Northern Blvd., Corona, is architect.

Bakery—First National Stores Inc., 5 Middlesex Ave., Somerville, Mass., awarded contract for a 3 story, 75 x 200 ft. bakery on Oakland Ave., East Hartford, Con., to Turner Construction Co., 178 Tremont St., Boston, Mass.

Bakery—General Baking Co., 420 Lexington Ave., New York, N. Y., awarded contract for a 2 story, 50 x 200 ft. bakery at 92nd St. and 102nd Ave., Long Island City, N. Y., to F. O'Hare, 270 Madison Ave., New York. Estimated cost to exceed $40,000. Also soon lets contract for addition to bakery at Louisville, Ky. Archer & Lloyd, 906 Pioneer Trust Bldg., Kansas City, Mo., are engineers.

Bakery—Green & Green Co., Cincinnati St., Dayton, O., plans the construction of a 4 to 6 story addition to bakery. Estimated cost $500,000. Architect not selected.

Bakery—Homestead Bakery, c/o A. Roy, Port Arthur, Tex., plans the construction of a 1 story bakery. Estimated cost $25,000. Work will probably be done by day labor.

Bakery—Inter City Bakeries, Ltd., Calgary, Alta, plans a 2 story bakery. Estimated cost $118,000.

Bakery—Jackson Bread Co., 46 Leeming St., L. Jackson, Mgr., Hamilton, Ont., plans to rebuild bakery destroyed by fire. Loss $100,000. High speed mixing and other equipment will be required.

Bakery — Northern Bakeries Ltd., 71 Richmond St., Toronto, Ont., is having plans prepared for the construction of a bakery. Estimated cost $100,000. S. Comber, 515 New Birks Bldg., Montreal, Que., is architect.

Bakery—Patterson Corp., 4050 Penn Ave., Kansas City, Mo., awarded contract for a 1 story, 139 x 189 ft. bakery at Chattanooga, Tenn., to Fogel Construction Co., 619 Reliance Bldg., Kansas City. Estimated cost $80,000.

Bakery—Pie Bakers of America, 1751 West Austin Ave., Chicago, Ill., awarded contract for masonry, etc., for a 2 story, 114 x 127 ft. bakery at 407-13 Wood St. N. Estimated cost $60,000.

Bakery—Rubel Baking Co., 574 West 6th Ave., Cincinnati, O., awarded contract for the construction of a bakery to Parkway Construction Co., Provident Trust Bldg., Cincinnati. Estimated cost $150,000.

Bakery — San Joaquin Baking Co., Fresno, Calif., awarded contract for the construction of a bakery at Bakersfield to J. Petersen, Fresno. Estimated cost including equipment $45,000.

Bakery, Etc.—Purity Bread Corp., 1819 Broadway, New York, N. Y., plans the construction of a 2 story, 78 x 121 ft. bakery, etc., at Sterling Pl. and Nostrand Ave., Brooklyn. Estimated cost $65,000. M. W. Del Gaudio, 545 5th Ave., New York., Archt. Maturity Sept. 20.

Bakery—Purity Bakeries, Ltd., Winnipeg, Man., awarded contract for a 2 story, 98 x 110 ft. bakery to Hazelton and Walin, 609 Electric Railway Chambers Bldg., Winnipeg. Estimated cost $120,000.

Bakery and Warehouse—Union Building Co., Union Bldg., Newark, N. J., is receiving bids for a 3 story bakery and warehouse at 10th St. and Fisher Ave., Philadelphia, Pa. Estimated cost $500,000. Ballinger Co., 105 South 12th St., Philadelphia, is architect and engineer.

Bakery and Warehouse—National Tea Co., O. H. Landin, V. Pres., 2837 3rd Ave. S., Minneapolis, Minn., awarded contract for the construction of a 3 story bakery and warehouse at Clinton Ave. and 29th St., to Standard Construction Co., 1111 Plymouth Bldg., Minneapolis. Estimated cost $150,000.

Baking Plant—Horn & Hardart, 600 West 50th St., New York, N. Y., are receiving bids for

the construction of a 3 story baking plant, at 605 West 49th St. Estimated cost $300,000. F. P. Platt & Bro., 211 West 57th St., New York, are architects. C. R. Place, 420 Lexington Ave., New York, is mechanical engineer.

Baking Plant—Van de Kamps Holland Dutch Bakers, Inc., J. E. Hopkins, 406 South Main St., Los Angeles, Calif., is having plans prepared for a 4 story baking plant on Orange Dr., Hollywood. Estimated cost $50,000. McCormick Co., 41 Park Row, New York, N. Y., is architect.

Bottling Plant—Leesburg Coca-Cola Bottling Co., Leesburg, Fla., plans the construction of a bottling plant. Estimated cost $15,000.

Candy Factory—Strobel & Hall, 194 North Clark St., Chicago, Ill., Archts., are receiving bids for the construction of a 2 story, 52 x 100 ft. candy factory at 2510 Maypole Ave. for Griswold Candy Co., 130 North Campbell Ave., Chicago. Estimated cost including equipment $40,000.

Chocolate Factory—Ambrosia Chocolate Co., 331 5th St., Milwaukee, Wis., awarded contract for a 3 story, 50 x 150 ft. factory to Selzer-Ornst Co., 192 4th St., Milwaukee.

Cannery—Gordon Valley Canning Co., L. Pecoraro, 458 North 7th St., Pres., San Jose, Calif., plans the construction of a cannery. Estimated cost $100,000. Architect not selected.

Canning Plant—Austin Brokerage Co., c/o C. A. Austin, Pres., Raymondville, Tex., will build a 2 story canning plant. Estimated cost $50,000. Work will be done by day labor.

Canning Plant (Grapefruit) — Lee County Packing Co., G. M. Heitman, Fort Myers, Fla., plans the construction of a grapefruit canning plant. Estimated cost $75,000.

Creamery—Dairy Products Co. and H. V. Larsen, Kingsville, Tex., plan the construction of a creamery at Alice. Estimated cost $45,000. Private plans. Complete machinery and equipment will be required.

Creamery Plant—San Antonio Irrigation Farms Co., San Antonio, Tex., plans the construction of a creamery plant at Natalia. Estimated cost $146,000.

Creamery and Produce Plant — Miller & Holmes, 18 East 3rd St., St. Paul, Minn., is having plans prepared for a 3 story, 62 x 120 ft. creamery and produce plant at Lafayette and Grove Sts. Estimated cost $80,000. Kampfer & Buetow, 1380 Blair St., St. Paul, are architects.

Creamery and Poultry Concentration Plant—Land O'Lakes Creameries, J. Brandt, Pres., 2201 Kennedy St., Minneapolis, Minn., plans the construction of a 3 story creamery and poultry concentration plant at Thief River Falls. Estimated cost $70,000.

Creamery and Poultry Plant—Swift & Co., North Fort Worth St., Fort Worth, Tex., is having preliminary plans prepared for the construction of a creamery (milk products) and poultry plant including cooling facilities, etc. at Paris. $150,000. Also plans a 2 story, 85 x 195 ft. distribution plant at Boston, Mass., and cold storage plant at Yoakum, Tex. $150,000.

Dairy—W. H. Roberts & Sons, 42nd St. and Millersville Rd., Indianapolis, Ind., awarded contract for a 2 story, 100 x 200 ft. dairy and creamery plant to E. B. Ball & Son, 1131 North Tacoma Ave., Indianapolis. Estimated cost $150,000.

Dairy Building—Thunder Bay Dairy Ltd., I. Seppala, Mgr., Port Arthur, Ont., awarded contract for a 1 story, 50 x 100 ft. dairy on Queen St., to Lakeside Building & Construction Co., Port Arthur. Estimated cost $60,000. Complete equipment will be installed.

Dairy Products Plant—Southwest Dairy Products Co., c/o E. T. Laubscher, 120 Josephine St., San Antonio, Tex., awarded contract for a 2 and 3 story dairy products plant at 120 Josephine St. to W. C. Thrailkill St., Real Estate Bldg., San Antonio. Estimated cost $115,000.

Milk Condensery — Whitehouse Milk Co., Stephenson, Mich., will soon award contract for a 2 story milk condensery. Estimated cost $30,000. J. E. Hennen, 116 South Main St., Fond du Lac, Wis., is architect.

Milk Plant—Bailey Farm Dairy Co., 5005 Alabama Ave., St. Louis, Mo., will build a 1 and 2 story, 61 x 140 ft. plant to include milk distribution plant, office, etc. at Alabama and Delor Sts. Work will be done by separate contracts.

Milk Plant—Douthitt Engineering Co., 100 West Monroe St., Chicago, Ill., and Local Stock Co., plan the construction of a 1 and 2 story milk plant at Lamesa, Tex. Estimated cost $200,000. Owner will build.

Milk Plant—Twin City Milk Producers Association, J. A. Lapham, Mgr., 1001 Glenwood Ave., Minneapolis, Minn., is having plans prepared for the construction of a 2 story, 92 x 182 ft. milk plant at Farmington. Estimated cost $100,000. M. Johnson, 4440 17th Ave. S., Minneapolis, is architect.

Milk Plant—Tyler Milk Products Co., D. B. Short, Tyler, Tex., will soon award contract for the construction of a milk concentration plant, including refrigeration equipment, etc., at Jacksonville. Estimated cost $28,000. Private plans.

Milk, Poultry and Egg Plant — Modern Dairies, Wilson, Wis., plans the construction of a milk, poultry and egg plant, also power plant. Estimated cost $350,000. Kampfer & Buetow, 1380 Blair St., St. Paul, Minn., are architects.

Cold Storage Plant—Fulton Markets, Inc., C. Greenblatt, West Main St., Waterbury, Conn., plans the construction of a 2 story cold storage plant on West Main St. Estimated cost $40,000. Private plans.

Cold Storage Plant—C. Gray, Brady, Tex., has acquired a site and plans a cold storage plant at Marble Falls.

Cold Storage Plant—New Orleans Fruit Co., Water and Harrison Sts., Flint, Mich., awarded contract for a 2 story cold storage plant to Spence Bros., Saginaw. Estimated cost $150,000.

Cold Storage Terminal — Sarasota Terminal Docks Inc., Sarasota, Fla plans the construction of a cold storage terminal. Estimated cost 00,000.

Cold Storage Warehouse—W. E. Wendell, 823 Merrell Ave., St. Petersburg, Fla., Archt., is preparing plans for the construction of a 1 story, 100 x 150 ft. cold storage warehouse, including 10 ton ice making equipment, etc. Estimated cost $50,000. Owner's name withheld.

Ice and Cold Storage Plant—Seminole Ice Co., South River Dr., is having plans prepared for the construction of an ice and cold storage plant. Estimated cost $18,000 to $20,000. Work will be done by owner's forces.

Ice Manufacturing Plant—Knickerbocker Ice Co., 41 East 42nd St., New York, N. Y., will receive bids in Sept. for the construction of a 4 story ice manufacturing plant at 409 East 60th St. Estimated cost $40,000. Private plans.

Ice Plant—Louisiana Ice & Utilities Co., Alexandria, La., will soon award contract for a plant including 1500 ton storage building, daily storage building, ice manufacturing plant, etc. S. Stone, Jr. & Co., Masonic Temple, New Orleans, La., are architects.

Ice Plants—Central Power & Light Co., Frost Bldg., San Antonio, Tex., is receiving bids for the construction of a 25 ton ice plant at Elsa; also will soon award contract for a 150 ton plant at Mercedes. Estimated cost $35,000 and $60,000 respectively. J. M. Marriott, Frost Bldg., San Antonio, is architect.

Ice Storage Warehouse—Southern United Ice Co., E. Loche, Mgr., McComb, Miss., is having preliminary plans prepared for the construction of a 60 x 60 ft. ice storage warehouse. Estimated cost $75,000.

Warehouse and Refrigeration Plant—C. P. Haudenshield, 21 Diamond Sq., Pittsburgh, Pa., is having plans prepared for a 3 story, 50 x 100 ft. warehouse, including refrigeration plant at Penn and 22nd Sts. Estimated cost $150,000. R. Marlier, Empire Bldg., Pittsburgh, is architect.

Food Products Warehouse — The Great Atlantic & Pacific Tea Co., 719 Brown Ave., Toledo, O., awarded contract for the construction of a 4 story, 85 x 150 ft. warehouse, to A. Bentley & Sons Co., 201 Belmont St., Toledo. Estimated cost $100,000.

Food Products Plant—Quaker Maid Co., subsidiary of Great Atlantic & Pacific Tea Co., 420 Lexington Ave., New York, N. Y., will soon award contract for a 6 story, 100 x 175 ft. plant at Terre Haute, Ind. Estimated cost $400,000. Private plans.

Tea Factory—Jewel Tea Co., 5 North Wabash Ave., Chicago, Ill., awarded contract for the construction of a 5 story, 115 x 400 ft. factory at Barrington to Lundorff-Bicknell Co., 100 North La Salle St., Chicago. Estimated cost $1,000,000.

Feed Mill—International Live Stock Feed Mills, 453 South Spring St., Los Angeles, Calif., awarded contract for the construction of a 60 x 280 ft. feed mill on Eastern Ave., to P. J. Walker Co., Garland Bldg., Los Angeles. Estimated cost $75,000.

Flour Mill—James Garritt, Chipman, Alta., plans the construction of a flour mill. Estimated cost $50,000.

Grain Elevator—Archer Daniels Midland Co., 600 Roanoke Bldg., Minneapolis, Minn., awarded contract for the construction of a grain elevator, 1,000,000 bu. capacity, to Fegles Construction Co., 529 South 7th St., Minneapolis. Estimated cost $300,000.

Grain Elevator—Galveston Wharf Co., 2324 Ave. B., Galveston, Tex., will build a grain elevator, 3,000,000 bu. capacity to include 84 x 232 ft. steel shed, 427 bins, four receiving elevator legs, sixteen auto power grain shovels, 8 bbl. action Patterson car door removers, auto fire pumps, fire alarms, scales, electric power motors, etc. Estimated cost $2,000,000. Private plans. Work will be done by day labor.

Grain Elevator—Ogilne Flour Mills Ltd, Manitou, Man., plans the construction of a grain elevator. Estimated cost $100,000.

Grain Elevator—Lake of the Woods Flour & Milling Co. Ltd, Manitou, Man., plans the construction of a grain elevator. Estimated cost $100,000.

Grain Elevator Addition — Capitol Elevator Co., 707 Bd. of Trade Bldg., Duluth, Minn., awarded contract for addition to grain elevator including sixteen bins, each 80 ft. in height, 1,400,000 bu. capacity on Garfield Ave. Fegles Construction Co. Ltd., 529 South 7th St., Minneapolis. Estimated cost $300,000.

Grain Elevator Addition—Maple Leaf Milling Co. of Canada, W. Steed, Mgr., Port Colborne, Ont., awarded contract for a 72 x 260 ft. addition to grain elevator, also 400 bbl. feed mill, new bag factory, etc. to Carter-Halls-Aldinger Co., Royal Bank Bldg., Winnipeg, Man. Estimated cost $250,000. Interested in prices on complete machinery and equipment.

Grain Conveyor Galleries—St. John Harbour Commissioners, St. John N. S., will soon award contract for the construction of grain conveyor galleries.

Mill—Vitimin Milling Co., Preston, Ont., is having plans prepared for a 3 story, 50 x 200 ft. mill on King St. Estimated cost 75,000. E. G. Wilson, c/o owner in charge of construction. Special equipment for milling health foods will be required.

Packing Plant — Krey Packing Co., 2100 Bremen St., St. Louis, Mo., awarded contract for a packing plant to include 2 story, 102 x 120 ft. pen building, 4 story, 150 x 300 ft. packing house building, etc., at Brement and North Florissant Sts., to Humes-Deal Construction Co., 777 Arcade Bldg., St. Louis.

Packing Plant—J. W. Lanney, B. G. Kilgore and V. Hall, San Angelo, Tex., will soon receive bids for the construction of a fresh meat packing plant. Estimated cost $100,000. Machinery and equipment will be required.

Packing Plant — A. and J. Overstreet, Palmetto, Fla., awarded contract for a 1 and 2 story, 80 x 150 ft. packing plant, to R. B. Jones, Palmetto.

Packing Plant—Texas Citrus Fruit Growers Exchange, c/o J. Shary, Pres., Mission, plans the construction of a 2 story packing plant at Edinburg. Estimated cost $60,000.

Packing Plant (Fig)—J. F. Forkner Packing Corp., Fresno, Calif., is having preliminary plans prepared for the construction of a fig packing plant. Estimated cost $100,000.

Produce Plant—Swift & Co., Ardmore, Okla., has acquired a site and plans the construction of a 3 story produce plant. Estimated cost $150,000. Private plans.

Salt Plant—Bishopric-Lent Co. Ltd., Dunkirk, Sask., plans the construction of a salt plant, including power house, etc. Estimated cost $350,000.

Sugar Refinery—Holly Sugar Corp., 453 South Spring St., Los Angeles, Calif., plans the construction of a sugar refinery at Stockton. Estimated cost $2,000,000.